RURAL INDUSTRIES RESEARCH
& DEVELOPMENT CORPORATION

Evaluation of the Prospective New Industry Program

An overview of all projects — stage 1

A report for the Rural Industries Research and Development Corporation

by Dr Jenny Gordon and Mr Leon Berkelmans

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Foreword

Good information is key to good project selection and management. This report reviews RIRDC's portfolios and their programs. Part 1, contained in this volume, provides an overview of the Prospective New Industry Program. Part 2, published as a separate report, provides detailed benefit-cost assessments of the returns to seven sets of projects in the portfolio, covering 21 projects. This review follows reviews of the Emerging Industry Program in 1998 and the Established Industry Program in1999.

The Prospective New Industry Program provides research and development opportunities for products that are either novel to Australian producers or yet to be widely developed as commercial products in Australia or abroad. The objective of research in this portfolio is to promote the development of viable new rural industries.

This report provides a brief history of all projects that have been completed or are currently underway in the New Animal and New Plant programs. As far as possible, inputs and outputs of each projects have been identified and the projects classified according to their area of impact as well as the activities undertaken. The projects are presented as projects sets, relating projects by contribution to common outcomes. In some cases there is a clear progression of projects as feasibility studies led to industry and R&D planning, which set directions for the following research projects.

An initial assessment of the likely outcomes of the projects was also undertaken. This assessment relies on program manager judgement of the success of the activities undertaken and the expected and actual response of industry. In many cases it was not possible to assess the likely impact as the research and/or the industry was still in a formative stage. However, of the projects which were assessed a range of values emerged. Overall the majority of the projects which were assessed were thought to have high outcomes. These include some projects that ended up demonstrating that an industry was not viable and so prevented unprofitable investment.

Apart from an indication of the returns to RIRDC's investment, the initial assessment highlights some issues for future consideration. The importance of industry cohesiveness for fledgling industries, and of RIRDC's role in promoting industry development through networking and improved communication was evident. The need to focus R&D activities in the early stages on producer driven concerns where returns were apparent also emerged as an issue. The increasing emphasis for research proponents to have undertaken basic market analysis and production trials, is clearly being rewarded in higher returns on more recent projects. And the benefits of some allocation to 'blue sky' research is also confirmed.

The assistance of RIRDC program managers, Dr Peter McInnes and Dr David Evans and other RIRDC personnel in undertaking this review is gratefully acknowledged.

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Contents

Foreword iii
Executive summary v

1. Introduction 1
   Motivation for this study 1
   Initial assessment 1

2. New animal products 9
   Overview 9
   General projects 11
   Meat and skins projects 16
   Birds for meat and other products 30
   Milk projects 41
   Other projects 48
   Further evaluation 54

3. New plant products 55
   Overview 55
   Bushfoods 57
   Culinary herbs and spices and beverages 64
   Extractive and fibre crops 81
   Prospective fruit, vegetable and nut crops 96
   Prospective grain and pulse crops 121
   Miscellaneous 132
   Further evaluation 141

4. References 143

Executive summary

The prospective new industry portfolio provides research and development opportunities for products that are either novel to Australian producers or yet to be widely developed as commercial products in Australia or abroad. The objective of research in this portfolio is to promote the development of viable new rural industries.

This report provides an overview of all projects completed or currently underway in the prospective new industry portfolio. The purpose is to:

- provide a reference source summarising the projects by classifying them by key objectives and outputs and demonstrating the links between projects; and
- make an initial assessment of the likely outcome of each project, or set of projects, as input into decisions on future project development and selection.

A summary of projects in the Prospective New Industry Programs

This review covers 306 projects in two programs — new animals and new plants. Considerable effort was made to identify all projects, and to collate accurate financial information. In addition to the 306 projects listed in the tables, there are a number of projects listed in the text for which little is known beyond the title. These projects are listed to provide as much information as possible as this report will be updated over time. Funding information for some projects understates industry contributions as in the early years of the program less attention was paid to assessing in-kind contributions.

Total funding for projects completed and currently underway is over $65 million, of which RIRDC has contributed $22 million, or 34 per cent. The plant program has been substantially larger than the animal program, reflecting the greater opportunities for the development of new plant based industries. Of RIRDC funding, 70 per cent has gone to the new plant program, with the program attracting 72 per cent of total funding. The funding for the programs is summarised in table 1.

The classification system was revised to map into the RIRDC system and to provide a generic structure that should be applicable for all projects in the RIRDC portfolio. Given the nature of the portfolio, a relatively higher share of funds can be expected to be allocated to industry development and training than in more established industries. This expectation is confirmed in the classification, which found that 14 per cent of funds in the animal had been allocated program, and 20 per cent in the plant program to industry development and training, compared with an average of 12 per cent in the established industry portfolio. Most funds are still allocated to production issues in both programs, the main difference being a greater emphasis on processing in the animal program. Again this is to be expected given the subjects of the programs, where meat, skins and milk products are the main end products for the animal program. The trend for more integrated production and processing is also emerging in plant products, for example with buckwheat and noodle production; however, fresh unprocessed product remains the dominant product type in the program. Table 2 summarises the classification for the two programs.

Projects were also described by the stage of development of the research. In brief, stage 1 projects are in the identification phase, stage 2 projects the development phase, and stage 3 the extension stage. In the prospective new industry programs a higher proportion of projects in stage 1 would be expected. Of RIRDC funding, Thirty five per cent for animal projects and 36 per cent for plant projects of RIRDC funding was identified as for stage 1 research. This is considerably more than for the well-established industries such as chicken meat and eggs. The share of RIRDC funding by stage of development is given in table 3.

1 Overview of portfolio funding

	Number of projects	RIRDC total	Industry total	Research organisation	Total	RIRDC total
	$	$	$	$	$	% of total
Animals	97	6 428 177	3 903 960	7 750 740	18 082 877	36
Plants	209	15 621 636	9 768 972	22 032 763	47 423 370	33
Total	306	22 049 813	13 672 932	29 783 503	65 506 248	34

Source: RIRDC database, compendiums.

2 Focus area of projects RIRDC funding

	Animals		Plants	
	RIRDC	Share	RIRDC	Share
	$		$	
Industry training and development	876 988	14	3 138 983	20
Communication/technology transfer	145 279	2	628 101	4
Production	3 594 313	56	9 242 163	60
Production, Markets			250 053	2
Production, Processing			231 910	2
Processing			1 029 756	7
Markets	836 480	13	921 543	6
Processing, Markets	965 117	15		
Total	6 418 177		15 442 509	

Note: For plants some projects could not be classified due to lack of information.
Source: RIRDC database, compendiums.

3 Share of projects by value at different stages in the project cycle

	Animals				Plants			
	RIRDC	Total	Share RIRDC funding	Share total funding	RIRDC	Total	Share RIRDC funding	Share total funding
	$	$	%	%	$	$	%	%
Stage 1	2 226 719	5 405 678	35	30	5 636 319	17 201 935	36	36
Stage 2	3 732 808	11 988 549	58	66	9 425 706	28 379 006	60	60
Stage 3	4 68 650	688 650	7	4	559 611	1 842 430	4	4
Total funding	6 428 177	18 082 877			15 621 636	47 423 370		

Source: RIRDC database, compendiums

Initial assessment

Assessments of the value of project outcomes to the relevant industry or the Australian public were provided by the program managers — Dr Peter McInnes for the new animal program, and Dr David Evans for the new plant program. Their efforts were greatly appreciated as considerable diversity of products that have been investigated under the program made this task a challenge, and the fledgling stage of the industries made estimation of impacts complex. It is important that such assessments are revisited in the future, and that more formal evaluations are undertaken to better read signals of project outcomes in the future.

There was considerable satisfaction with many of the projects undertaken, with 34 per cent of the animal projects by funding and 29 per cent of the plant projects rated as having a high return. There is still a tendency to rate projects well that have good scientific or other outputs, without sufficient screening based on the potential of the industry. For a substantial number of projects it was considered

too early to make any assessment, in part because of the recent and on-going nature of the research, and in part because of the early stage of the industry involved. Some projects considered having high returns have done so by preventing inappropriate investment — assessment of the impact of such research will always be difficult as it requires judgement about likely investment. Table 4 provides a summary of the assessments.

4 Initial assessment by total RIRDC funding

	Animals		*Plants*	
	RIRDC		*RIRDC*	
	$	%	$	%
High	2 204 023	34	4 449 197	29
Medium/ High	166 409	3	1 340 668	9
Medium	285 008	4	1 881 107	12
Low/ Medium	799 082	12	217 774	1
Low	394 147	6	601 873	4
Too early	2 579 508	40	3 501 260	23
Not known			3 629 757	23
Total	6 428 177		15 621 636	

Source: RIRDC database, compendiums

Considering the trend in the types of projects funded over time there continues to be a wide diversity in the products receiving R&D funding. This suggests that the program is playing its role of providing support for more unusual rural products well. There is a clear trend to less funding for the very early stages of investigation of industry viability. Assistance is still available for rigorous analysis of industry viability, but the early questions such as 'can it grow?' and 'where do we sell the product?' are expected to have already been addressed in the background to any research proposal. There is also a greater trend to a holistic approach to industry development, using the R&D funding and planning as leverage to improve industry structures and communication.

Seven sets of projects were selected for a more formal assessment in stage 2 of this report. They all fall into the production category, as these projects are most amenable to evaluation. However, it was agreed that while difficult to evaluate, an assessment of the efficacy of various industry development models being pursued by RIRDC might be of value to program managers in refining their approach.

1. Introduction

Motivation for this study

This report is the third in a series of reports reviewing the performance of RIRDC's programs. It reviews the Prospective New Industry Program — new animals and new plants. The objective of the review is to document the history and development in each program and to learn from past experiences — lessons to guide future investment by RIRDC.

There are two stages in the review. The first stage reviews the projects in the programs in each portfolio. The review classifies all past projects that can be identified in terms of their objectives, stage of research and financing. Projects contributing to common outcomes are identified as project sets that must be considered together in any formal evaluation. An initial assessment based on a judgement by the program manager of the actual or likely impact of the project is made. Projects or project sets that would be interesting to evaluate more formally are also identified. The second stage of the review undertakes these benefit cost evaluations.

The projects are classified in a number of ways to assist in understanding what type of research has been undertaken in the program, what the objectives of the research were, or are expected to be, and how useful to the industry and consumers the research has turned out to be. This information is important in helping to address the prospectivity of research proposals. It can also assist in identifying gaps in the research agenda that have a high prospectivity or potential return.

Prospectivity of a research proposal depends on:

- the likely success of the science or method — will the answer be found by the research agenda;
- the benefits that flow from adoption of the research outputs; and
- the adoption of these outputs, which is dependent on the benefits, but also on the position of the industry, attitudes of the producers, and external competitive pressures.

While an assessment of prospectivity should be based on expected future conditions, lessons from past experience are an essential input into judgement.

Initial assessment

Initial assessment looks beyond the success of the project in delivering outputs, and involves judging the actual or potential outcomes. In many cases it is difficult to identify likely outcomes because of the early stage of the R&D. Even when it is too early to identify the outcome, the process of looking for outcomes helps to focus attention on sequencing of research and on resource and timing issues. In the prospective new industry portfolio this sequencing is particularly important.

Stage of development

The stage of development of the research refers to the type of research being undertaken and has implications for the expected outcome. Stage 1 research is preliminary investigations or basic research. But is may also be work aimed to establishing R&D plans or industry plans. Many of the projects undertaken in the prospective new industry program are in this early stage, where it is always difficult to assess the outcome.

Stage 2 projects usually focus on particular problems and have well defined objectives in terms of outcomes. Projects in this stage can usually be evaluated, as there is a well-defined output. Stage 3

projects are more on the development end of R&D, and include most of the communication or extension type projects. The impact of these projects is often diffuse and hence difficult to evaluate.

A substantial proportion of projects in the new industry programs are 'high risk' projects, with considerable uncertainty not only in the 'science' but also in the potential benefits, and in adoption. A pattern in the research agenda has emerged that works to minimise uncertainty by continually screening out new products that will not be commercially viable. Five steps are often followed.

- Identification of market opportunities — increasingly this step must be undertaken before appealing to RIRDC for research support. Such projects would be classified as stage 1.
- Demonstration of production capabilities — preliminary work is also increasingly required to have been undertaken prior to application for funding. Projects of this nature would be classified as stage 1.
- Assessment of economic feasibility — this is where RIRDC's role should begin as additional expertise is required to assess potential economic viability. While there may be markets, and the product can physically be produced, Australian producers must be competitive in the world market, or against imports in the domestic market, or offer domestic consumers a valued new product. The competitive edge can come from superior product (price premiums for quality and/or value adding), and from production advantages (higher yields, lower input costs, better management and so on). This step also should identify where further research is of greatest benefit. Projects of this nature are mostly stage 1.
- Assistance in industry development — this takes identified R&D opportunities forward, but more importantly sets up industry structures to develop communication to overcome commercial impediments to industry development. These projects tend to be stage 1 and stage 3.
- Addressing specific knowledge gaps and problems solving — this is the well recognised end of the R&D spectrum assisting industry by enhancing ties between researchers and producers and providing financial support. In new industries, research is often at the stage 1 end of the spectrum, and as more projects move into the stage 2 area the industry often graduate to the emerging industry or other R&D programs.

Classification

Three levels of classification are introduced in this report. This builds on the classification system in previous reviews. Ideally a generic system will emerge that is appropriate for all programs. The classification system is summarised in table 1.1.

The first level in the classification system mirrors the RIRDC classification. It points to the place on the value chain where the project output should have an initial impact. Consumers are potentially impacted by all changes but few impacts are direct.

- Industry training and development potentially impacts on all points on the value chain, but particularly on the producers. The impact is usually diffuse.

1.1 The classification system

Level 1	*Code*	*Level 2*	*Code*	*Level 3*
Production systems	P1	Production systems	1	Management
				Occupational health and safety
				Plant physiology
				Husbandry
				Viability
	P1	Breeding	2	Technology
				Genetics
				Hybridisation
				Selection
				Germplasm conservation
				Evaluation
	P1	Reproduction/establishment	3	Preparation
				Propagation
				Technology
				Fertility
	P1	Nutrition	4	Fertilizer
				Irrigation
				Diet
				Management
				Assessment
	P1	Disease	5	Vaccines
				Treatments
				Diagnosis
				Management
	P1	Pest/weed	6	IPM
				Herbicides
				Pesticides
				Biological control
				Identification
				Assessment
	P1	Harvest	7	Machinery
				Management
	P2	Environmental sustainability		Externalities
				Sustainable yield
				Salinity resistant
		Animal welfare		Codes of practice
				Protocols
				Shelf-life
				Health
Processing	PR	Post-harvest treatment		Protocols
				Shelf-life
				Health
		Simple processing		Slaughter
				New properties
				Packaging
				Quality

			Evaluation
		Complex processing	Technology
			New properties
			Evaluation
Distribution/Storage/Transportation	DST	Cool chain management	
		Distribution	
		Storage	
		Transportation	Mixed loads
			Live transport
		Market research	Opportunities
			Domestic
			Import replacement
			Export
		Competitiveness	Competitors
		Quality control	Quality management systems
			Descriptions
			Standards
			Quarantine
			Food safety
		Industry	Newsletters
			Networks
			Publications
			Information systems
			Seminars
			Demonstration
			Technical support
		Consumer	Confidence
			Industry/product promotion
			Health and safety
Industry training and development	TD	Training/capacity building	Financial management
			Marketing
			Production systems
		Development	Industry Associations
			Industry planning
			R&D planning
			Benchmarks (best practice)
			Economic analysis
			Impediments
			Property rights

- Communication and technology transfer is very similar to industry training and development where the impact occurs. Impact may be further up the value chain where the projects focus on processing and distribution.
- Production impacts on the primary producers, being concerned mainly with issues of growing and harvesting (slaughtering). Activities at other points in the value chain are affected through changes in production costs, quantities and quality.

- Transport, handling and storage initially impacts on the providers of these services, but changes in costs and services offered affect the returns to producers and processors.
- Processing projects impact initially on processors but come to affect producers and consumers through changing demands, price and quality.
- Markets refers to projects that seek and develop market opportunities for fresh and processed product and so impact on both producers and processors.

The second level of the classification system describes the target of the research. In many cases this matches the objective, but not in all, where objectives are highly specific such as increased yield. For example, a 'production' project may focus on plant or animal nutrition, or on developing new systems for production. Industry development and training is split into development and training. 'Communication' is divided by target audience — consumers, producers, processors, transporters, and so on. 'Markets' is split by the objective, whether market intelligence on existing markets and products (market research), quality control, or identification of new opportunities.

The third level of the classification provides more detail on the type of research activity. For example, a project in industry development may conduct an economic analysis to assess feasibility of the industry, or undertake R&D planning. A project on nutrition could be looking at irrigation or fertilizer for plants, while for animals it might be on pasture or feedstuff. For market research the third level identifies which markets are the focus of the research — domestic or export.

The classification is an attempt to summarise in a few words the main characteristics of the project. The relationships between projects, as well as the classification, are set out in charts. These charts provide at a glance a summary of the programs to date. Proposed research should be seen against the backdrop of previous projects to see where it fits into the charts — highlighting previous research that might be of interest and suggesting the benefits that might arise from the research.

Guidelines for assessing the impact

These guidelines for assessing the initial impact were provided in a previous report (Gordon and Davis 1999). They are repeated here for the readers unfamiliar with making such assessments. The guidelines are really a set of questions, which must be asked in forming a judgment of the impact of the project.

This is done only informally in this report, and only where the information is easily available.

What is the initial impact?

Where demand or supply or both change with R&D output depends on the specific output. However, there are a few general guidelines in making an assessment of the impact of the project.

Changes in on-farm production inputs, systems, and outputs shift supply. The change is usually summarised by changes in the unit cost of production. Raising yields, lowering fixed costs, reducing inputs per unit output are all aimed at improving production levels or reducing production costs.

Changes in quality — increasing the average level and/or the consistency of product (and in meeting specified guidelines for quality) — raise the quality. Changes will impact on demand and, if production costs are affected, on supply.

Changes in shipping and handling and/or processing influence the derived demand for farm product, affecting demand. From the perspective of suppliers of these services these changes will impact on their supply.

Changes in marketability — raising consumer awareness of products and producer awareness of market opportunities, R&D aimed at changing consumer attitudes and behaviour — will influence demand.

Additional information for initial assessment

Stage I in the GRDC and RIRDC *Guidelines for Economic Evaluation of R&D* sets out a process for identifying the likely impact of an R&D project based on a set of information about market structure.

To provide a flavour of the kind of information that is required to provide such initial assessments — and to assess the complexity of a full evaluation — a number of questions are listed below. In an initial assessment these questions are not answered formally, but they are for program managers and others to keep in mind when asked to make an assessment of the outcome of a project or project set.

Product description

These questions are designed to identify the market conditions that affect the impacts of the R&D output. In particular it is important to understand whether the outputs of the R&D and their adoption will influence prices — of the product, of other products, and of inputs. And if so, how they will influence price.

- What are current prices and production levels?
- Does Australian production (or a region's production, if the R&D is only applicable to the region) influence price?
- If the R&D results in development of a new product or an expansion of existing activity — what did it replace?

R&D description

The main issue in the R&D description is to identify the initial impact or shock brought about by the R&D. There are two parts to this, the output of the R&D and where on the value chain this output is adopted.

The objective and the output of the R&D identify the desired initial impact of the R&D. For example the initial impact of the R&D could be a new product, improvement in an existing product (which includes greater consistency of quality as well as better quality), lower production costs through better management, and so on. However, the output may not have a physical representation, for example I the case of market knowledge, or a strategy for development. These are intermediate outputs. For intermediate outputs to have an effect they have to lead to final outputs.

The types of questions that need to be answered depend in part on the initial impact of the R&D. But they have a similar theme.

- Is there a final output — does something physical such as quality, quantity, cost — change?
- How does it change? This leads into what does it change — is the impact likely to be on the demand or supply side or both?
- Is all production equally affected? Is the effect regional? Will different varieties or grades of product be affected in different ways?
- Will competing producers (including foreign producers) adopt the change?

These questions lead into the big question of how to follow through the impact of the change. The point in the value chain (or points) where change occurs will influence this answer if we know something

about the structure of the industry. The following questions target this information. They are also important in assessing the distributional impacts of the change.

- How many steps are there in the value chain?
- What are the shares (of final price to the consumer) along the value chain?
- How do these shares adjust to changes along the chain?
- Are there outputs that are likely to impact on people outside the value chain? That is, are there any major externalities likely to be associated with the output?

Stage of R&D

The stage of R&D is very useful in identifying what needs to be included in an evaluation. All projects contributing to a particular initial impact should be included in a project set for evaluation. For example, if a project is at the extension stage all the costs associated with bringing the output to commercial use — including private costs — should be included in the assessment. It is in this section that a rough judgment about likely adoption (or evidence on actual adoption) needs to be formed and the questions focus on this aspect.

- Are there plans to go to the next stage of R&D?
- Who is funding the next stage?
- How easy/widespread is commercial adoption likely to be or has been?

Another area of questions should seek to establish the counterfactual, that is, the 'without' scenario. This has several elements as can be seen by the types of questions to be addressed.

- Would funding for the activity have been forthcoming from another (private) source if not funded by RIRDC?
- Would a lower level of funding have resulted in the same output?
- What would have been the improvement in output for a slightly higher level of funding?
- What activities might have been undertaken if the project had not?

The final area of questions is aimed at providing information about the risk associated with the project. There are several sources of risk.

- Was the project undertaken as a way of dealing with or insurance against a possible future event? Did such an event arise? Is such an event still expected to arise?
- Did any major changes in market conditions, technology or other factors impacting on the value of the R&D output arise that were not foreseen at the commencement of the project? What is their impact on the value of the R&D output?
- Was the project considered 'high risk' — having a low probability of success — at its commencement? Note that high-risk projects, even if they fail to produce an output, are not necessarily bad projects. Identification of 'dry hole' could save considerable resources from being committed in the future. Furthermore, by their nature very high return projects are often high risk, and any portfolio should contain some high risk, high return projects.

Initial assessments

Although this report does not answer any of these questions explicitly, they provide the information that goes into the judgements made in the initial assessments. As far as possible, the expected outcomes of the projects are assessed. In some cases it will be too early to make any judgment as the success of the

output is still uncertain. In most cases where the projects are completed, and no other project follows on, the success is known, but there are a few old projects for which no information is readily available.

Given the lack of formal process in making the initial assessment the assessments of the outcomes of successful projects are limited to low, medium and high. Direct comparisons cannot be made between the program as the assessments were based on different perceptions on what a good pay-off is. They reflect, however, considerable effort by the program managers to utilise their knowledge of the industry to assess the actual or potential value of the R&D output to the industry and, for some projects, the broader community.

There are four main steps in an evaluation.

- Identify the outputs of the R&D and how they have directly affected demand and/or supply at each point in the value chain. This includes impacts that may not be quantifiable such as environmental effects.
- Develop a model of the market(s) likely to be impacted by the R&D. If a non-market effect consider how to estimate such impacts.
- Quantify the initial impact (shift in demand/supply) — to get the shock.
- Apply this shock to the market model, or non-market model to estimate the impact at each point in the value chain.

2. New animal products

Overview

Sub-program objectives

The new animal product program was formally established in 1993 with the appointment of the Research Manager. The objective of the program is to accelerate the development of viable new animal industries. The key strategies for 1999-2000 are:

- identify R&D priorities;
- assess RIRDC's opportunity to fund innovative R&D;
- facilitate market development based on customers' demands;
- fund production, processing, transport and storage R&D on animal products;
- consider both profitability and resource maintenance and enhancement in selecting R&D; and
- stimulate co-funding from industry, enterprises and public sector interests.

Ninety-seven projects have been undertaken under the program. These include three projects that were completed prior to 1994. They are included in the charts that illustrate the relationships between projects for the purpose of understanding the evolution of the R&D in each industry.

Program areas

The five main areas in the program under which projects can be classified are as follows.

- General — where the focus is on projects that provide R&D relevant to the majority of new animal industries.
- Meat and skins — where the focus is on R&D that improves productivity and/or quality of new animal meat and skin products as well as market development activities including animal welfare. To date this category includes:
  - antelope
  - buffalo
  - camel
  - crocodile
  - kangaroo
  - wallaby
  - hare
  - rabbit.
- Birds for meat and other products — with a similar focus as the previous subprogram, but for birds. The main species are:
  - emu
  - ostrich.
- Milk — the focus of the R&D is on non-cow milk production and milk products. The main species are:
  - dairy sheep
  - goats.
- Other — a wide range of projects are funded under this program that do not fit under any of the categories listed above. For example, projects on the export potential of native birds and reptiles,

silkworms, snails, goannas and toads have been covered under the NAP. Also some fibre projects are funded that do not fit into the rare natural (animal) fibre program.

Funding

The annual budget of the program is around $0.9 million. Since the establishment of the program RIRDC has contributed (or committed) $6.4 million. This has been enhanced by industry contributions of $3.9 million and research organisation contributions of $7.6 million.

Table 2.1 summarises the expenditure on research in each of these categories since the inception of the program.

2.1 Total and share of expenditure by sub-program and major species

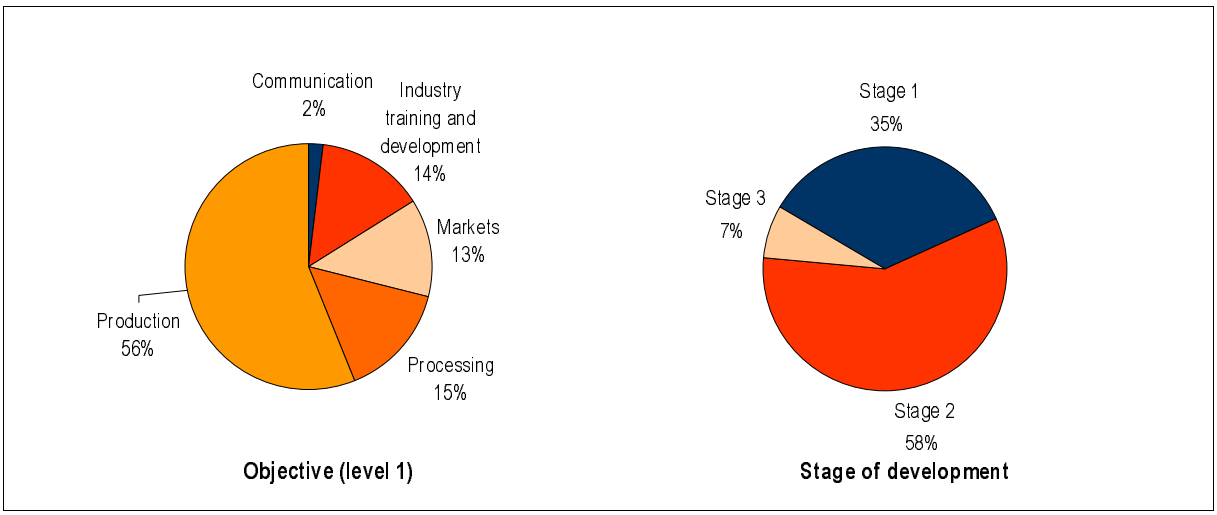
	Number of projects	*RIRDC total*	*Industry total*	*Research organisation total*	*Total*
		$	$	$	$
General	11	666 654	119 172	193 660	979 486
Meat and skins	34	2 019 406	797 836	3 938 931	6 756 173
Birds for meat and other products	30	1 820 576	1 064 762	2 324 904	5 210 242
Milk	12	1 325 718	1 380 690	928 557	3 634 965
Other	11	595 823	541 500	364 688	1 502 011
Total	97	6 428 177	3 903 960	7 750 740	18 082 877

Source: RIRDC database, compendiums.

Types of research

As outlined in chapter 1, research can be categorised by the point of the value chain where it is directed as well as the research activities undertaken. It can also be categorised by the stage of product development. Chart 2.2 gives the share of RIRDC funding allocated by each of these classifications. It shows the emphasis of the overall program on where in the value chain R&D occurs and the stage of development. As expected in the new industry portfolio, the majority of projects are in stage I, however, the majority of expenditure is in product development — stage 2.

2.2 Share of RIRDC funding allocated by level 1 and stage of development

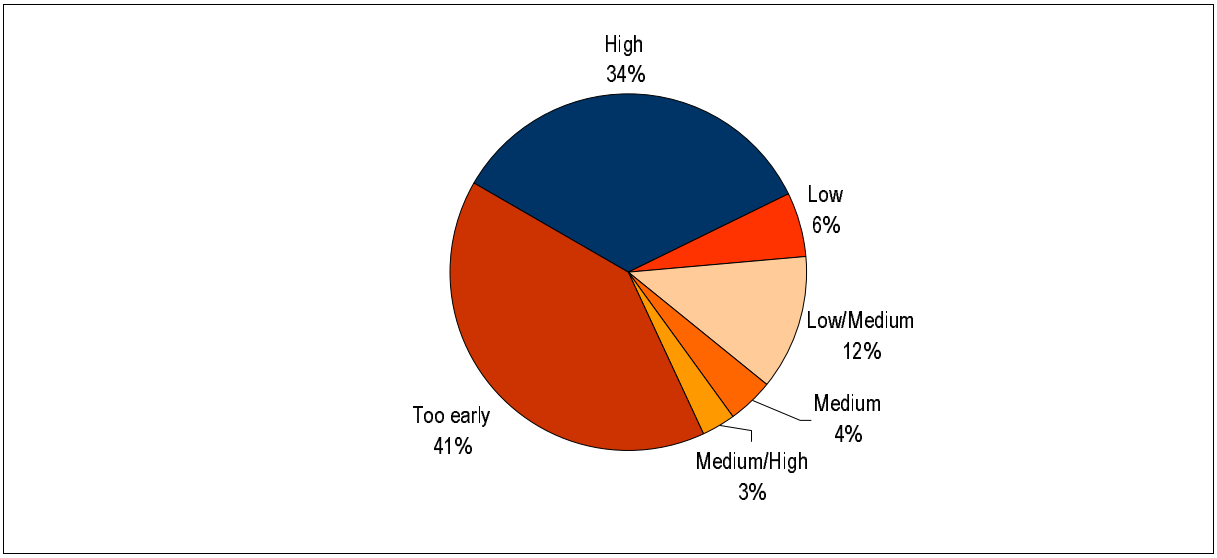


Data source: RIRDC database, compendiums.

Initial assessment

Overall the program is judged to have performed well. Chart 2.3 summarises the outcome of the initial assessment.

2.3 **Initial assessment for the new animal program**



Data source: RIRDC database, compendiums.

Details of the projects are provided below, by category. The financial data is the sum of expenditure — actual and committed for on-going projects — on the project.

General projects

Projects

There have been 11 projects that have been fairly general in nature, cutting across a number of new animal products at a cost of a little under 0.7 million for RIRDC. The total cost of the projects is around $1 million. The first National Conference on New Rural Industries was conducted jointly with the New Plant program. The funding information provided in the tables is based on the RIRDC database. In some cases there has been additional funding from industry or research organisations that is not reflected in the table. Where possible these projects are noted in the tables. Table 2.4 summarises the funding for these projects.

2.4 New animal projects timing and cost General

Project	*Code*	*Start date*	*Finish date*	*RIRDC total*	*Industry total*	*Research organisation total*	*Total*
				$	$	$	$
Alpaca Enterprise Budgeting Software	RID-2A	1/08/99	1/08/00	27 500	2 000	20 850	50 350
Strategic Industry Discussion Paper on Prospective Australian Animal Industries[a]	DAV-160A	1/03/99	5/07/99	15 000	0	0	15 000
First National New Rural Industries Conference, Perth 1998 (with plants)	DAW-90A	15/01/98	30/11/99	50 000	17 000	84 500	151 500
Increasing the Value of Wild Animal exports	DPI-2A	1/07/88	30/07/92	71 976	6 000	0	77 976
Marketing of New Animal Products[a]	MCK-1A	1/11/96	30/06/98	130 000	0	0	130 000
Development of Statistical and Logistical Information Systems for New Animal Industries	PTP-1A	1/07/95	31/05/98	53 816	0	5 000	58 816
A New Innovative Approach to Semen Collection Techniques	UMO-13A	1/07/95	30/09/97	46 600	53 400	23 752	123 752
Pharmacological Induction of Seminal Emission and Ejaculation in Domestic Species	UMO-25A	1/10/99	1/10/01	28 850	38 772	28 850	96 472
Performance Benchmarks for Selected New Animal Products	WHP-2A	1/08/99	1/08/03	222 610	0	15 025	237 635
Ostrich Enterprise Budgeting Software	RID-1A	14/07/98	30/01/99	20 302	2 000	15 683	37 985

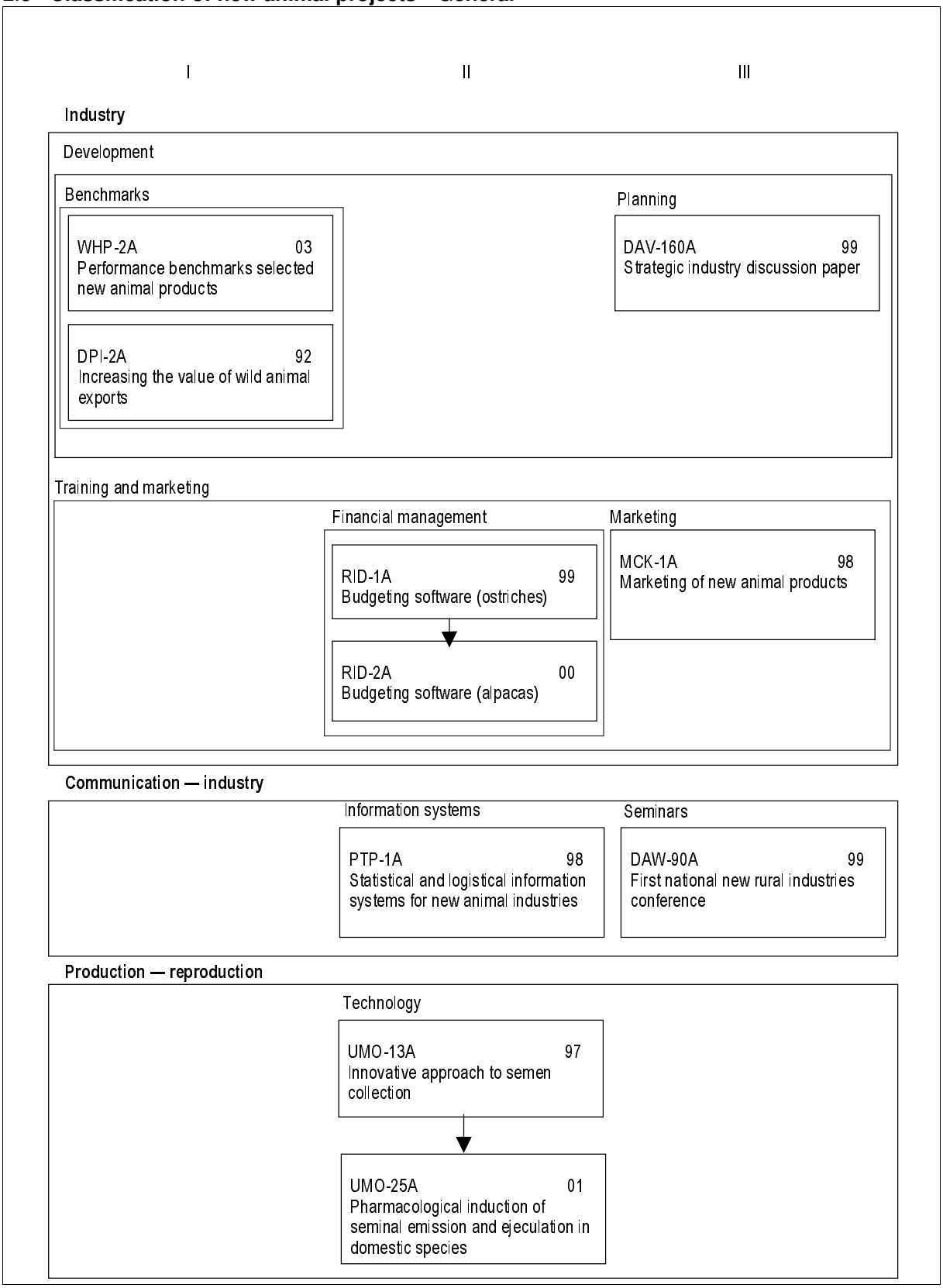
[a] Industry contributions were made to these projects but are not recorded.

Source: RIRDC database and files.

Classification

The projects are mainly in the area of industry development, involving benchmarks, planning and communication. However, there are several that are more specific, in particular the set on semen collection. The classification is illustrated in chart 2.5, and summarised in table 2.6.

2.5 Classification of new animal projects General



2.6 **Initial assessment of new animal projects General**

Product	*Project*	*Code*	*Stage*	*Level 1*	*Level 2*	*Level 3*	*Evaluation*
Alpaca	Alpaca Enterprise Budgeting Software	RID-2A	2	Industry training and development	Training	Financial management	Too early
General	First National New Rural Industries Conference, Perth 1998	DAW-90A	3	Communication / technology transfer	Industry	Seminars	High
General	Development of Statistical and Logistical Information Systems for New Animal Industries	PTP-1A	2	Communication / technology transfer	Industry	Information systems	Medium
General	Marketing of New Animal Products	MCK-1A	3	Industry training and development	Training	Marketing	High
General	Performance Benchmarks for Selected New Animal Products	WHP-2A	1	Industry training and development	Development	Benchmarks	Too early
General	Strategic Industry Discussion Paper on Prospective Australian Animal Industries	DAV-160A	3	Industry training and development	Development	Industry planning	Too early
General	Increasing the Value of Wild Animal Exports	DPI-2A	1	Markets	Market research	Domestic/ Export	High
General	A New Innovative Approach to Semen Collection Techniques	UMO-13A	2	Production	Reproduction	Technology	Too early
General	Pharmacological Induction of Seminal Emission and Ejaculation in Domestic Species	UMO-25A	2	Production	Reproduction	Technology	Too early
Ostrich	Ostrich Enterprise Budgeting Software	RID-1A	2	Industry training and development	Training	Financial management	Too early

Source: RIRDC database and files.

Initial assessment

The initial assessment is based on the program manager's judgement of the outcome of the project. A summary of each project group, set out in chart 2.5 is provided in table 2.6. It is too early to assess the outcomes of most of these projects. The expected return on the projects that can be assessed is generally high.

Industry

Three projects can be classified as promoting industry development, and three focusing on training — two on financial management and one on marketing.

- WHP-2A develops *Performance Benchmarks for Selected New Animal Products*. It is a current project with four years to run and it is too early to judge the impact of the project.
- DPI-2A *Increasing the Value of Wild Animal Exports* resulted in an important book being published called 'Commercial Uses of Wild Animals in Australia' by BJ Ramsey, 1994. The research established the knowledge gaps in these industries and provided good benchmarks for their development. It attracted a lot of publicity and was considered to have set a good base for the ostrich and emu industries and so is considered to have had a high payoff.
- DAV-160A is a *Strategic Industry Discussion Paper on Prospective Australian Animal Industries*. The final report has just come in and it is considered too early to evaluate. Hopefully

the outcome will be a workshop leading to a pseudo-common organisation for the prospective industries. The next step is still under consideration.

- RID-1A (Ostrich) and RID-2A (Alpaca) assisted the development of *Enterprise Budgeting Software*. These two projects are classified in the general category as the outputs are hopefully easily transferred between new animal industries. RIRDC's role was restricted to the development of the software, leaving the private partner to promote it. There is an Intellectual Property agreement that will be used as a basis for sharing revenue resulting from the sales that are made. Spin-offs from this project may result from the promotion of the software. Farmers may see benefits in recording data that they previously had not. The pay-off for the ostrich project is thought to be medium while it is too early to determine the benefits of the alpaca version, although it is anticipated that these will be high.
- MCK-1A looks at the *Marketing of New Animal Products* and resulted in a very good document on the marketing and status of new industries. Considerable media attention was attracted, particularly on the radio, increasing awareness and providing a significant spin-off from the project. It has been very helpful in setting priorities and the assessment of the net benefit is high. The report is *Marketing of New Animal Products*, number 99/53.

Communication to industry

There have been two projects that can be classified as improving communications to industry.

- DAW-90A funded the *First National New Rural Industries Conference*, in Perth in 1998. (It should be noted that plants as well as animals were examined at this conference.) By looking at the processes associated with the development of new industries the conference has been considered to be a stepping stone to many programs. A workshop the day after, funded by AFFA, determined areas that attention needed to be paid to. This lead to the establishment of the New Industries Development Program, which was introduced last federal budget. RIRDC is represented on the board of this initiative, which assists commercialisation and complements RIRDC's work. The expected payoff is quite high.
- PTP-1A developed a *Statistical and Logistical Information System for New Animal Industries*. This project was initiated due to the recognition that information provided by traditional sources on new animal industries was inadequate. It is thought that the benefits of clearer R&D priority setting would outweigh the costs of collecting the information. The systems were aimed at the industry associations but have not been widely adopted because of the resources involved, the nature of the industries, the rapid turnover of board members in these associations and the fact that these associations do not represent all industry members. Due to the lack of adoption, the net benefit of the project would probably be medium.

Production – reproduction

Two projects UMO-13A and the follow on project UMO-25A are developing a new innovative approach to semen collection through pharmacological induction of seminal emission and ejaculation in domestic species. The projects aimed to develop techniques for species where existing methods were not appropriate. UMO-13A didn't get enough information, so UMO-25A was funded. The second project is too early to evaluate at the present time.

Meat and skins projects

Projects

Thirty-four projects have been undertaken that have been classified in this category, attracting RIRDC funding of over $2 million, and total funding of $6.8 million. Of these 7 projects focused on kangaroo (with RIRDC funding of $0.32 million), 10 on crocodile ($0.75 million), and 6 on camels ($0.26 million). Table 2.7 summarises the funding for these projects.

2.7 New animal projects timing and cost Meat and skins

Project	*Code*	*Start date*	*Finish date*	*RIRDC total*	*Industry total*	*Research organisation total*	*Total*
				$	$	$	$
Production Characteristics of Farmed Blackbuck Antelope	UQ-20A	1/07/91	30/06/94	18 966	12 000	11 259	42 225
Australian Buffalo Market Research and Industry Feasibility Study	BUF-1A	1/03/98	30/05/00	65 000	13 000	4 000	82 000
Development of Reproductive Technology to Allow Increased Productivity from Cross Breeding Riverine and Swamp Buffalo	DAV-132A	31/05/97	30/06/99	105 000	15 000	118 000	238 000
Can Australian Camels Race Competitively Overseas?	AWC-1A	1/07/98	1/03/98	10 000	8 250	0	18 250
To Develop An Ecological and Economically Sustainable Camel Industry Through an Integrated National Approach — Qld	DAQ-218A	1/12/96	30/05/99	34 500	6 000	28 859	69 359
Develop an Ecologically and Economically Sustainable Camel Industry Through an Integrated National Approach	DAW-81A	1/07/96	1/12/96	15 000	3 000	41 462	59 462
Assessing Potential for Development of Commercial Camel Industry in Western Australia	DAW-92A	1/02/99	31/01/01	15 000	0	20 000	35 000
To Develop an Ecologically and Economically Sustainable Camel Industry Through an Integrated National Approach - NT	DNT-19A	1/11/96	30/06/98	119 400	64 000	26 000	209 400
Cograzing of Cattle and Camels for Commercial Production	DNT-20A	1/07/97	30/06/01	64 000	49 520	110 588	224 108
Support for Crocodile Farming: Intensive Tropical Animal Production, Seminar	DAQ-114A	7/08/91	8/08/91	6 400	—	—	6 400
Crocodile Farming in Queensland: Research into Husbandry Practices	DAQ-132A	1/07/92	30/06/95	106 578	44 220	298 554	449 352
Market Development and Product Specification for the Crocodile Meat Industry	DAQ-149A	1/07/93	30/06/94	49 200	10 000	57 000	116 200
Crocodile Farming: Research, Development and On-farm Monitoring	DAQ-188A	1/07/95	30/09/98	145 000	141 700	851 179	1 137 879
Designing a Research Facility for Grower Size Crocodiles	DAQ-220A	1/07/96	30/03/97	13 692	—	54 426	68 118
Electrical Restraining, Stunning and Stimulation of Crocodile	DAQ-229A	1/07/97	31/12/99	43 309	9 500	23 080	75 889

Improved Nutrition and Management of Farmed Crocodiles: Hatching to Harvest	DAQ-247A	1/07/98	30/05/01	183 710	128 100	1 257 690	1 569 500
Aetiology of Giant Cell Enterohepatitis in Farmed Crocodiles	UJC-3A	1/07/92	1/07/94	6 000	3 000	18 000	27 000
An Investigation of Skin Diseases in Farmed Crocodiles	UJC-5A	1/07/97	30/06/99	57 690	9 200	57 549	124 439
Improving the Quality of Australian Crocodile (Crocodylus porosus) Skins	WMI-1A	1/01/97	30/06/99	140 400	105 000	180 900	426 300
Commercial Development of Cartilage Co-Products from Alternative Production Species	CST-5A	1/01/99	31/12/99	25 000	1 000	18 559	44 559
Identification of Meat in Products from Non-Traditional Species to Maintain Consumer Confidence — Phase I	UMU-10A	1/07/92	30/06/93	31 063	0	9 000	40 063
Market Characteristics and Opportunities for Skin Products of Emerging Animal Industries	DAQ-258A	1/10/99	1/10/01	105 000	28 506	55 000	188 506
The Economic Production of European Brown Hare (Genus Lupus)	LSC-1A	1/07/99	15/03/00	2 000	0	4 000	27 000
Kangaroo Meat Trading Language and Specification Manual	AM-4A	1/01/98	30/06/98	3 000	0	0	33 000
Specifications for Kangaroo Skin Trading Inception Project	AM-5A	15/12/98	30/04/99	1 380	0	0	10 380
Kangaroo Skins Trading Project	AM-6A	9/06/99	30/05/01	4 000	0	0	44 000
Investing in R&D for Profitably Marketing Kangaroo Products	C93	—	—	3 050	—	—	30 050
Kangaroo and Kangaroo Products Awareness, Attitudes and Usage by Australians	Consultancy Project		—	27 000	—	—	27 000
Enhancing the Unique Properties of Kangaroo Leather	CWT-1A	1/08/99	30/07/01	145 948	106 000	242 600	494 548
Assessment of the Impact of Government Regulations on the Commercial Operation of the Australian Kangaroo Industry.	MAC-3A	24/06/95	13/08/95	26 500	0	0	26 500
The Prospects for the Development of the Rabbit Meat Industry in Australia	ABA-7A	1/07/98	30/05/99	17 596	0	0	17 596
Farmed Rabbits for Growth in Australian Agriculture	CSU-1A	1/08/99	30/07/02	237 219	27 100	125 206	389 525
Assessment of Sustainable Yield Levels of the Kangaroo Island Tammar Wallaby, Macropus Eugenii	UA-40A	1/07/97	15/03/98	8 140	13 740	6 020	27 900

Classification

Chart 2.8 illustrates the classification of the projects by the main focus of the research. The full range of topics is represented. The progression of projects roughly conforms to that set out in chapter 1, with early projects assessing production and economic viability, followed by industry development projects, including assessment of R&D needs, then addressing those needs. These are both production and market orientated. The classification is given in table 2.9.

Initial assessment

The assessment of the outcomes of the projects is mixed, but more projects fall on the high than low side. There are many projects where it is too early to say what the impact will be. Where the industry is very small, the value of the impact is limited, so high cost projects are unlikely to deliver large benefits. Table 2.9 summarises the assessment.

Antelope

One project has been funded on antelope. UQ-20A examined the *Production Characteristics of Farmed Blackbuck Antelope*. It was a feasibility study that showed production in Australia was going to be limited. This may have prevented wasted resources going into this area, and there have been research projects that have been rejected on the basis of this research. However, the payoff is judged to be quite low.

Buffalo

Prior to 1985 there was a large buffalo industry in Australia. Approximately 40 000 animals were slaughtered every year and there were considerable exports to the EEC. In 1985, however, the federal government initiated the Brucellosis and Tuberculosis Eradication Program (BTEC) to cull large feral herds that may transmit bovine tuberculosis. This lead to a 90 per cent reduction in the feral herd and production fell accordingly. Currently the majority of Buffalo production comes from the Northern Territory, but there are now enterprises established in Victoria, New South Wales, Western Australia and South Australia. There were 700 buffaloes slaughtered in 1995, which is only a fraction of pre-1985 production. Of the 700 that were slaughtered, 300 were feral beasts and 400 were farmed buffalo. However the industry is growing slowly, with approximately 1000 animals being processed in 1998.

2.8 Classification of new animal projects Meat and skins

I II III

Antelope

Production systems

UQ-20A 94
Production characteristics

Buffalo

Market research

BUF-1A 00
Industry feasibility

Production — breeding

DAV-132A 99
Reproductive technology to increase productivity

Camels

Industry — development

Planning

DAW-81A 96
Integrated national approach to developing industry — WA

DAW-92A 01
Potential development in WA

Marketing — quality control

DNT-19A 98-99
Integrated national approach — NT

Production — systems

DNT-20A 01
Co-grazing cattle and camels — NT

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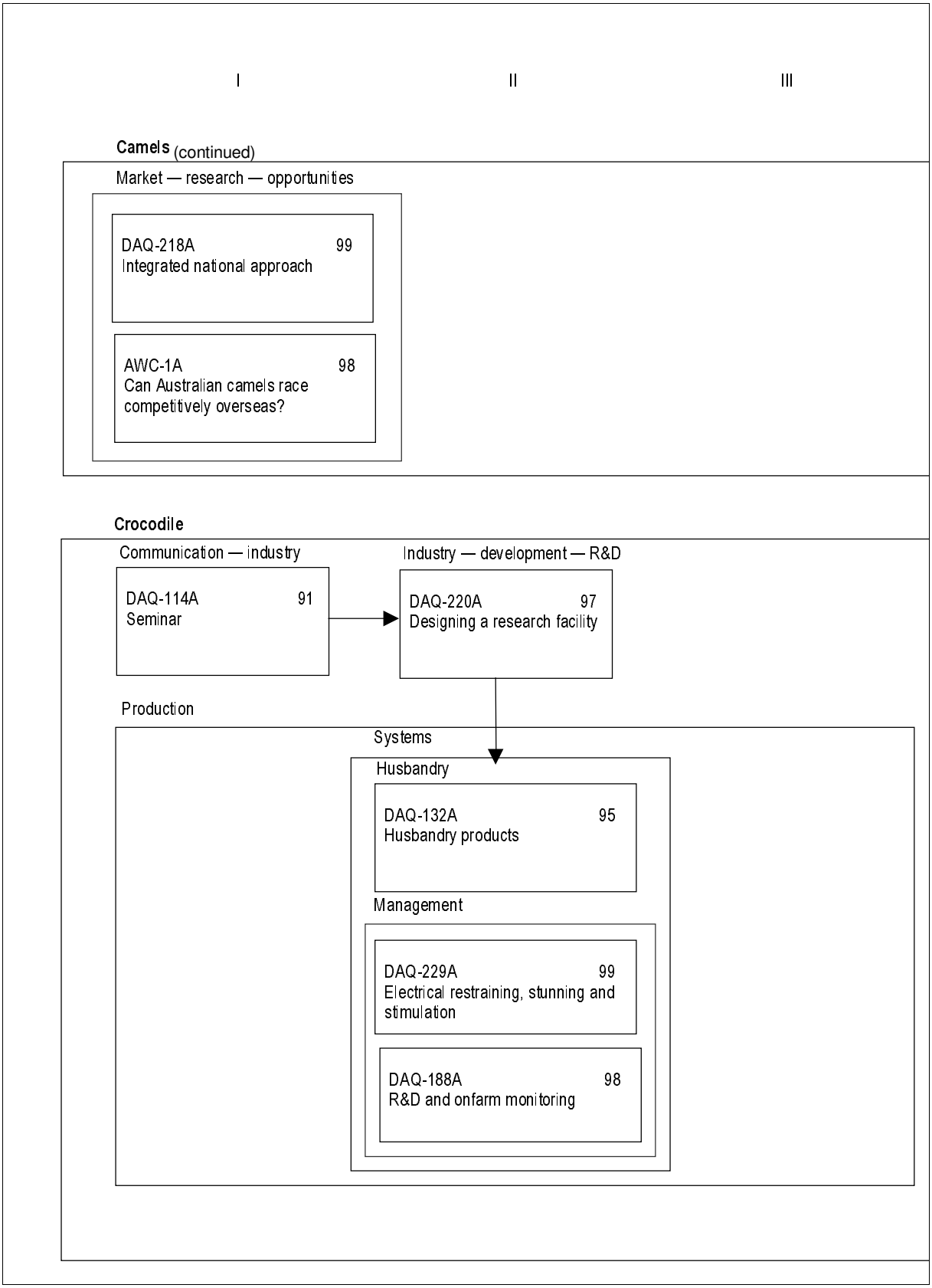
2.8 **Classification of new animal projects Meat and skins** (Continued)



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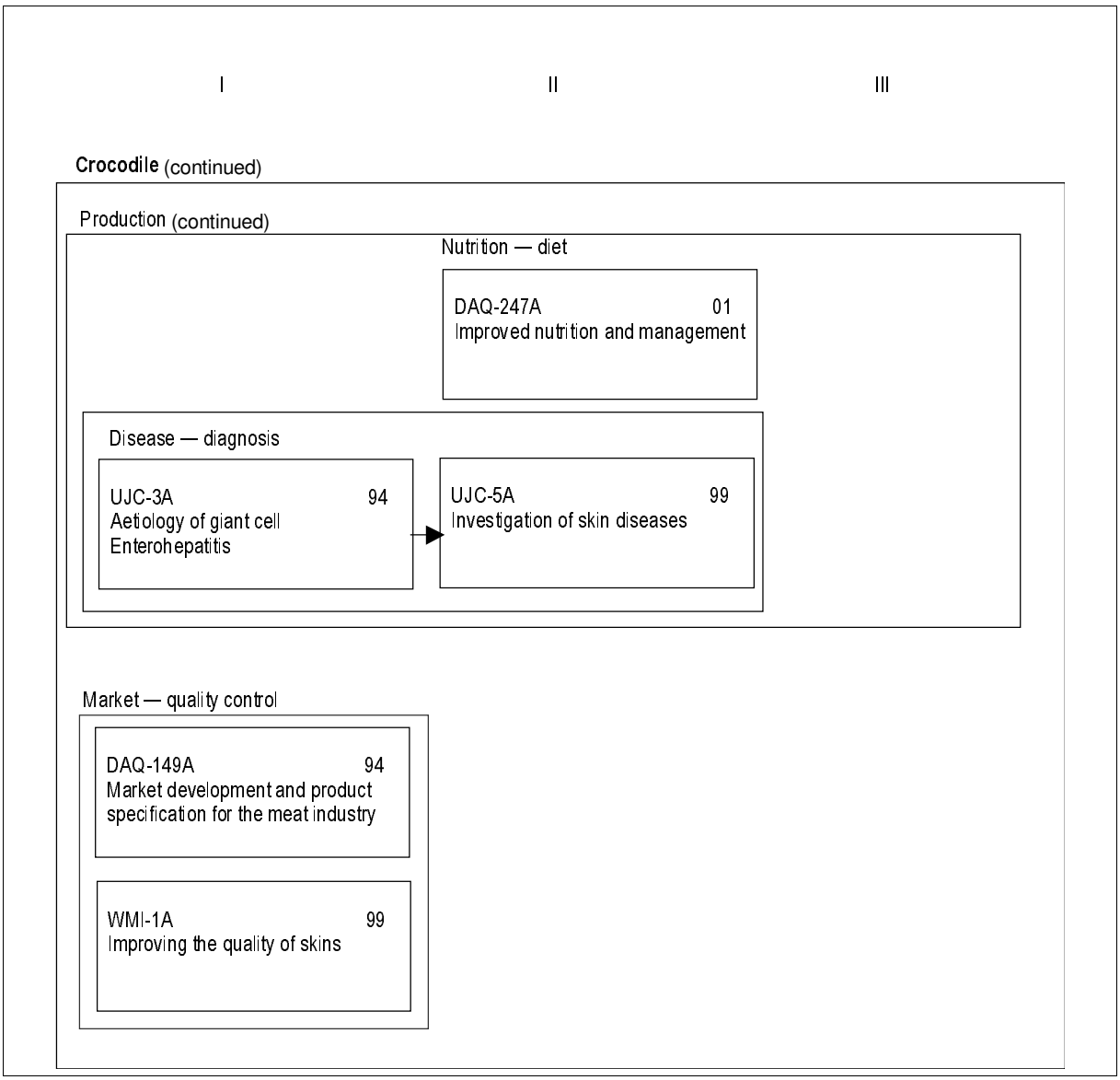
2.8 **Classification of new animal projects Meat and skins** (Continued)



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2.8 **Classification of new animal projects Meat and skins** (Continued)

I II III

Kangaroo

Industry development

Impediments

MAC3A 95
Impact of government regulations on the commercial operation

R&D Planning

AM-6A 01
Kangaroo skins trading project

Market

Research

C93 93
Investing in R&D for profitably marketing kangaroo products

Consultancy 96
Kangaroo and kangaroo products awareness, attitudes and usage by Australians

Quality control — specifications

AM-5A 99
Specifications for skin trading inception project

AM-4A 98
Meat trading language and specification manual

Processing — simple

CWT-1A 01
Enhancing the unique properties of kangaroo leather

(Continued on next page)

2.8 **Classification of new animal projects Meat and skins** (Continued)

I II III

Hare

Industry development

LSC-1A 00
Economic production of European brown hare

Rabbit

Industry development

ABA-7A 99
Prospects for the development of the rabbit meat industry

Production — selection

CSU-1A 02
Farmed rabbits for growth

Wallaby

Production — environmentally sustainability

UA-40A 98
Sustainable yield levels of the Kangaroo Island Tammar wallaby

General

Market — quality control

DAQ-258A 01
Market characteristics and opportunities for skin products

Communication — consumer — confidence

UMU-10A 93
Identification of meat in products from non-traditional species

CST-5A 99
Development of cartilage co-products

2.9 Initial assessment of new animal projects Meat and skins

Product	Project	Code	Stage	Level 1	Level 2	Level 3	Evaluation
Antelope	Production Characteristics of Farmed Blackbuck Antelope	UQ-20A	1	Production	Systems	Husbandry	Low
Buffalo	Australian Buffalo Market Research and Industry Feasibility Study	BUF-1A	1	Markets	Market research	Opportunities	Too early
Buffalo	Development of Reproductive Technology to Allow Increased Productivity from Cross Breeding Riverine and Swamp Buffalo	DAV-132A	2	Production	Breeding	Technology	Too early/ Medium
Camel	Develop an Ecologically and Economically Sustainable Camel Industry Through an Integrated National Approach	DAW-81A	1	Industry training and development	Development	Industry planning	Too early
Camel	Assessing Potential for Development of Commercial Camel Industry in Western Australia	DAW-92A	1	Industry training and development	Development	Industry and R&D planning	Too early
Camel	To Develop an Ecologically and Economically Sustainable Camel Industry Through an Integrated National Approach — NT	DNT-19A	1 2	Markets	Quality control	Standards	High
Camel	Can Australian Camels Race Competitively Overseas?	AWC-1A	1	Markets	Market research	Opportunities	Low
Camel	To Develop An Ecological and Economically Sustainable Camel Industry Through an Integrated National Approach — Qld	DAQ-218A	1	Markets	Market research	Opportunities	Too early
Camel	Cograzing of Cattle and Camels for Commercial Production	DNT-20A	1	Production	Systems	Management	Too early
Crocodile	Support for Crocodile Farming: Intensive Tropical Animal Production, Seminar	DAQ-114A	3	Communicatio n / technology transfer	Industry	Seminars	High
Crocodile	Designing a Research Facility for Grower Size Crocodiles	DAQ-220A	1	Industry training and development	Development	R&D Planning	High
Crocodile	Market Development and Product Specification for the Crocodile Meat Industry	DAQ-149A	1	Markets	Quality control	Descriptions	Medium
Crocodile	Improving the Quality of Australian Crocodile (Crocodylus porosus) Skins	WMI-1A	1	Markets	Quality control	Quality management systems	Too early
Crocodile	An Investigation of Skin Diseases in Farmed Crocodiles	UJC-5A	2	Production	Disease	Diagnosis	High
Crocodile	Improved Nutrition and Management of Farmed Crocodiles: Hatching to Harvest	DAQ-247A	2	Production	Nutrition	Diet	High
Crocodile	Crocodile Farming in Queensland: Research into Husbandry Practices	DAQ-132A	2	Production	Systems	Husbandry	High
Crocodile	Crocodile Farming: Research, Development and On-farm Monitoring	DAQ-188A	2	Production	Systems	Management	High
Crocodile	Electrical Restraining, Stunning and Stimulation of Crocodile	DAQ-229A	2	Production	Systems	Management	High

Crocodile	Aetiology of Giant Cell Enterohepatitis in Farmed Crocodiles	UJC-3A	1	Production	Disease	Diagnosis	Low
General	Identification of Meat in Products from Non-traditional Species to Maintain Consumer Confidence - Phase I	UMU-10A	2	Communicatio n / technology transfer	Consumer	Confidence	Low
General	Commercial Development of Cartilage Co-Products from Alternative Production Species	CST-5A	2	Processing	Simple Processing	New properties	Too early
General	Market Characteristics and Opportunities for Skin Products of Emerging Animal Industries	DAQ-258A	1	Markets	Quality control	Specifications	Too early
Hare	The Economic Production of European Brown Hare (Genus Lupus)	LSC-1A	1	Industry training and development	Development	Economic analysis	Too early
Kangaroo	Investing in R&D for Profitably Marketing Kangaroo Products	C93	1	Industry training and development	Development	R&D Planning	High
Kangaroo	Assessment of the Impact of Government Regulations on the Commercial Operation of the Australian Kangaroo Industry.	MAC-3A	1	Industry training and development	Development	Impediments	Medium
Kangaroo	Kangaroo Skins Trading Project	AM-6A	1	Industry training and development	Development	R&D Planning	Too early
Kangaroo	Kangaroo and Kangaroo Products Awareness, Attitudes and Usage by Australians	Consultancy Project	1	Markets	Market research	Domestic	High
Kangaroo	Kangaroo Meat Trading Language and Specification Manual	AM-4A	3	Markets	Quality control	Specifications	High
Kangaroo	Specifications for Kangaroo Skin Trading Inception Project	AM-5A	1	Markets	Quality control	Specifications	Too early
Kangaroo	Enhancing the Unique Properties of Kangaroo Leather	CWT-1A	2	Processing	Simple processing	Quality	Too early
Rabbit	The Prospects for the Development of the Rabbit Meat Industry in Australia	ABA-7A	1	Industry training and development	Development	Economic analysis	Medium/ High
Rabbit	Farmed Rabbits for Growth in Australian Agriculture	CSU-1A	2	Production	Breeding	Selection	Too early
Wallaby	Assessment of Sustainable Yield Levels of the Kangaroo Island Tammar Wallaby, Macropus eugenii	UA-40A	1	Production	Environmental sustainability	Sustainable yield	Low/ Medium

Source: RIRDC database and files.

Two projects on buffalo have been recently been funded.

- BUF-1A *Australian Buffalo Market Research and Industry Feasibility Study* undertook market research on the industry, particularly for southern states. It is too early to tell what sort of effect this information will have, however, it looks as though buffalo could be a feasible industry. Some trial marketing is being done in Sydney exploiting opportunities for a niche market, rather than focussing on ethnic communities.
- DAV-132A *Development of Reproductive Technology to Allow Increased Productivity from Cross Breeding Riverine and Swamp Buffalo* is classified as a production project focusing on breeding. It is also too early to tell with any sort of accuracy what the outcome will be, but it

suspected to be medium, as some things were successful — such as artificial insemination but others, such as '*in vitro*' fertilisation were not as successful as required commercially.

Camel

Australia's population of feral camels is estimated to be about 200 000. Scientists calculate that culling 8 per cent of this herd per year is the minimum required to prevent further environmental damage, a statistic that gives considerable scope for the establishment of a camel industry. Development of a commercial camel industry occurred in 1988, and in 1998 there were 324 animals slaughtered. In 1999 there were 18 pastoralists involved in camel farming, each running herds of 100–500, but feral camels make up a large majority of the production. All production of meat is currently consumed domestically yet there are prospects for export markets to Asia and the Middle East. Live exports, fibre and by-products such as oil also have potential

Six projects on camels have been funded. All but one — on racing— concentrate on meat and livestock production and form a coordinated approach to research across the Northern Territory, Queensland and Western Australia. A project was funded in each of the three states under the title of *Developing an Ecologically Sustainable Camel Industry Through an Integrated National Approach*. The focus of the research differed across the three projects, as has follow on projects in Western Australia and the Northern Territory.

- In Western Australia DAW-81A focused on industry development and planning. The follow on project, DAW-92A, assesses the *Potential for Development of a Commercial Camel Industry in Western Australia*. It is considered too early to assess these two projects. DAW-81A was concerned with the logistics of the industry and where it is best to slaughter the animals for shipment to markets. This part is being published, but it is difficult to assess how much interest it will generate, particularly from the department in Western Australia.
- In the Northern Territory, DNT-19A focused on processing and marketing. This project is just in its final stages but appears to have a high pay-off. Two documents have been published and another is in the process of being released. The industry has used some of the results of the work on a meat specific language and handling in preparation for camels destined for abattoirs. The project, DNT-20A *Cograzing of Cattle and Camels for Commercial Production,* looks at production systems, but it is too early to assess the likely outcome of this project.
- In Queensland the project DAQ-218A has provided a comprehensive report for the domestic market, but the benefits of this are too early to evaluate. It found that education was required in the marketplace if consumption was to be promoted wider than ethnic communities.
- The project AWC-1A *Can Australian Camels Race Competitively Overseas?,* led to a published report recommending the importation of some camels. It was aimed at developing an industry, with some potential exports to Dubai. However, there is not much scope for productive investment in the industry resulting in a low return to the project.

Crocodile

As at June 1998, The Northern Territory had the largest population of farmed crocodiles in Australia, at approximately 40 000. Production is increasing in Queensland and Western Australia, and it is expected that these states will provide half the skin production in the near future. The industry was worth about $500 000 in 1995, a figure which had risen to $4.2 million by 1997-98. Skins account for a little under 90 per cent of this market value, although all prime cuts of meat are sold. In 1994 Australia imported 140 tonnes of meat from Papua New Guinea to satisfy domestic demand. Skin production is exported to markets in France, Japan and Italy.

There are nine completed projects and one on going. They concentrate on industry development, product development and improving production. A set of six crocodile projects is evaluated in stage 2 of this report.

- DAQ-114A, *Support for Crocodile Farming: Intensive Tropical Animal Production*, funded an industry seminar and overseas travel. This project was the basis for the development of the crocodile industry, setting R&D priorities. The payoff is expected to be high because of the interest it generated and because it led to the establishment of a research facility, which is project DAQ-220A.
- DAQ-220A, *Designing a Research Facility for Grower Sized Crocodiles*, has funded the establishment of a research facility in Townsville. This research facility was used in the following two sets of projects, so the whole set should be evaluated together
- There are three projects that are related in developing production systems. These are:
  - *DAQ-188A Crocodile Farming: Research, Development and On-farm Monitoring,*
  - *DAQ-132A Crocodile Farming in Queensland: Research into Husbandry Practices,*
  - *DAQ-229A Electrical Restraining and Stimulation of Crocodile.*
- Related to these projects is one on nutrition — DAQ-247A *Improved Nutrition and Management of Farmed Crocodiles: Hatching to Harvest.*

The payoff from these four projects is estimated to be medium to high due to the quality of results (these are evaluated in stage 2). Also, the results have been widely disseminated through the industry newsletter and industry association meetings.

- Two projects investigate diseases. They are linked through background knowledge rather than the research itself. UJC-3A *Aetiology of Giant Cell Enterohepatitis in Farmed Crocodiles* was an academic study and the application of the results to industry might be difficult. It is thought that the evaluation of this project might be low, but some elements of the industry may have used some of its findings. UJC-5A *An Investigation of Skin Diseases in Farmed Crocodiles* is a current project. A high payoff is expected because the results so far have been simple, for example the project found that alterations to the water supply alleviate some of the investigated skin conditions or the addition of low cost chemicals. Because of this these practices have been or probably will be widely adopted. This project was mainly to do with fungal problems which affects skin value, but skin damage is also related to other things such as stress.
- DAQ-149A *Market Development and Product Specification for the Crocodile Meat Industry Market* can be classified as markets — quality control. In addition to the marketing focus of the project a trading language was also developed. This project would probably result in a medium payoff because the publication detailing the trading language and appropriate cuts of meat from crocodiles was good, but some or all of the industry might have already been using the results.
- WMI-1A *Improving the Quality of Australian Crocodile Skins* is too early to evaluate. It is designed to develop, at the embryonic stage, better follicles through control of such factors as temperature and humidity.

Kangaroo

The commercial kangaroo industry is increasingly being appreciated for its advantages in minimising the marsupial's impact on the environment, providing employment opportunities in rural areas and additional export avenues for a unique Australian product. Each year quotas for commercial and non-commercial harvesting are established to ensure the survival of the species and contain its environmental impact. One of the major challenges for the industry is that it must operate effectively in this climate of regulated supply. This challenge has been met very well, with exports over the past decade increasing from $12 million to $40 million. It is, however, difficult to estimate overall production levels due to the

concentration of ownership, commercial confidentiality and fluidity of the market. It is possible to say that the majority of skins are destined for the export market, accounting for $33 million of the $40 million of exports in 1996-97, and the majority of meat is processed for pet food but there is a growing market for human consumption. Exports of this product rose 17 per cent in 1996-97.

There have been seven projects on kangaroo. The main areas of research have been in the market area and industry development.

There have been two projects in industry development.

- C93 *Investing in R&D for Profitably Marketing Kangaroo Products* was a consultancy project, prepared by Macarthur Consulting, that investigated priorities for R&D. Two key findings lead to the development of two new projects: MAC-3A and the consultancy project researching market awareness. It was a good report in itself but it should be considered as an input into these other two projects and consequently cannot be assessed alone.
- MAC-3A *Assessment of the Impact of Government Regulations on the Commercial Operation of the Australian Kangaroo Industry* found that different regulations existed in each state and these inconsistencies impeded the development of the industry. While it is difficult to judge the impact that this report may have had, there might have been some response to it in terms of refining regulations to enhance compatibility. Therefore the project has been assessed as having a medium impact.
- AM-6A *Kangaroo Skins Trading Project* aims to establish an advisory group for the skins processing industry and determines various requirements for research. It is too early to assess the impact of this project.

Assessment of the market conditions and activities to help develop a market has also been a priority.

- A Consultancy Project *Kangaroo and Kangaroo Product Awareness, Attitudes and Usage by Australians* followed on from C93. A wide-ranging report detailing attitude and awareness of kangaroo products was produced. There does not appear to have been much follow up work, but at the time the report did receive a lot of media attention. The publicity it received should have enhanced its impact so the project is thought to have had a high impact.
- There are two projects that focus on specifications and descriptions for quality control.
  - AM-4A *Kangaroo Meat Trading Language and Specification Manual*, is anticipated to have a high payoff and is considered to be worth further evaluation. The project produced a document that is being widely used both domestically and overseas. At the time the manual was not seen as an important priority by some sectors of the community, but has since been widely adopted and been very effective. While it was only a small project, the wide and quick dissemination of the material can be explained by the small and dynamic nature of the industry. This project is evaluated in stage 2 of this report.
  - AM-5A *Specifications for Kangaroo Skin Trading Project* is too early to evaluate and should be considered part of the skins trading project.
- CWT-1A *Enhancing the Unique Properties of Kangaroo Leather,* is too early to evaluate. It focuses on simple processing of skins.

Hare

One project on hares has been undertaken. Classified as industry —development, LSC-1A, *The Economic Production of European Brown Hare*, is a feasibility study in response to the collapse of the European industry after an outbreak of the calicivirus. It's current and too early to evaluate the impact.

Rabbit

The farmed rabbit industry started in 1988 in Western Australia when state legislators lifted bans on the practice and in 1995 New South Wales followed suit. Currently Victoria is also in the process of establishing the industry. Rabbit farming has suffered severe contractions three times since 1988, but the outbreak of the calicivirus has meant that the supply of wild rabbits has fallen, exposing a gap in the market that farmed rabbits can fill. Currently farm production stands at $400 000-500 000, or 55 tonnes, which is a fraction of the gap which is estimated to be 1000 tonnes. However, there are some question marks over the viability of rabbit farming at current indicative prices.

There are two projects on rabbits.

- ABA-7A *The Prospects for the Development of the Rabbit Meat Industry in Australia.* This project confirmed that the industry was feasible, but marginal depending on a number of factors, for example effective R&D. The findings generated a lot of interest and publicity, for example coverage of the report was given in the Daily Telegraph and on the ABC. Spin-offs of this nature would have resulted in a medium/high impact on the industry.
- CSU-1A *Farmed Rabbits for Growth in Australian Agriculture* followed on from ABA-7A. It addresses breeding and husbandry health issues of farmed rabbits. It is also too early to evaluate.

Wallaby

Since 1990 wallaby numbers commercially harvested under Commonwealth approved management plans have dwindled from nearly 15 000 to below 1000. The largest commercial cull of wallabies occurs in Tasmania, although there is no management plan for wallabies in Tasmania apart from Flinders Island. Production of game meat in Tasmania was estimated to be 65 tonnes in 1994-95. Furs were exported until 1986 to manufacturers in Italy, Japan and Germany, but since then there has been poor demand for wallaby products overseas.

One project on wallabies is classified as production — environmental sustainability. UA-40A *Sustainable Yield Levels of the Kangaroo Island Tammar Wallaby,* was a project funding an honours student to determine sustainable yields of the wallaby. If this project had any effect then it was quite small. However, even a small effect could provide reasonable payoffs because little money was invested in this project.

General

There are three projects that are relevant to more than one species in this category.

- UMU-10A *Identification of Meat in Products from Non-traditional Species to Maintain Consumer Confidence,* is classified as a communication-consumer-confidence objective. This project was in response to growing concerns that things such as kangaroo meat were being used in some products without the knowledge of the consumer. There was never any phase 2 to this project because the techniques developed were quite costly and better techniques have since been developed. It is assessed to have a low return.
- DAQ-258A *Market Characteristics and Opportunities for Skin Products of Emerging Animal Industries* is a market research project. It is too early to evaluate.
- CST-5A *Commercial Development of Cartilage Co-products from Alternative Production Species* was undertaken in response to the fact that shark cartilage is considered by some to have anti-cancer properties, and now that sharks are endangered to some degree, alternative sources need to be found. Some animals, for example crocodiles, were identified to have cartilage with similar chemical characteristics as sharks. Potency is also an issue that was examined in the project.

However, this project will not be enough in itself to encourage development of any products — issues such as supply need to be considered. It is too early to assess if further work is justified on this topic because the report has only just been submitted.

Birds for meat and other products

Projects

There have been 30 projects classified under birds for meat and other products. With the exception of one project on meat ducks the projects have been on emus (14) or ostriches (13), with several projects (2) addressing issues common to both birds.

Table 2.10 provides the information on funding of the research. The total expenditure by RIRDC has been $1.8 million, and the total funding $5.2 million. Emus have attracted $0.89 million of RIRDC funds and ostriches $0.54 million, with $0.32 million on joint projects.

2.10 **New animal projects timing and cost Birds for meat and other products**

Project	*Code*	*Start date*	*Finish date*	*RIRDC total*	*Industry total*	*Research organisation total*	*Total*
				$	$	$	$
Self-Selection of Diets by Growing Meat-type Ducks	UQ-76A	15/07/98	30/06/00	38 730	51 000	21 000	110 730
Adding Value to Emu Co-products	ADP-1A	15/07/99	30/11/00	21 600	0	17 000	38 600
Investigation of the Viability of Commercial Emu Farming in Tasmania	DAT-19A	1/07/90	30/06/93	15 480	0	0	15 480
Investigation of Growth Rate and Cost Factors Affecting Commercial Emu Rearing Using Cool Climate Forage Based Production	DAT-32A	1/10/95	30/06/97	23 700	22 000	26 266	71 966
Emu Processing and Product Development	DAW-34A	1/01/92	31/12/94	180 159	30 000	373 440	583 599
Emu Product Research — Oil and Leather	DAW-57A	1/07/94	1/07/97	217 641	19 000	387 432	624 073
Determination of the Anti Inflammatory Properties of Emu Oil	DAW-82A	30/11/97	30/06/99	75 000	0	77 500	152 500
Determining the Efficacy of Emu Oil in Wound Healing and Cellular Regeneration	DAW-83A	30/11/96	29/09/97	5 000	—	—	5 000
Anti-inflammatory Properties of Emu Oil	SAR-20A	31/05/99	31/05/00	21 000	187 000	5 000	213 000
Neuroanatomical and behavioural Consequences of De-clawing in Commercially Farmed Emus	UF-2A	1/07/97	15/09/99	79 252	12 000	35 136	126 388
Co-ordinated Emu Research Program - Overcoming the Constraints of the Egg-laying Season	UWA-25A	1/07/94	30/06/97	137 981	205 857	288 355	632193
A Preliminary Investigation of the Anti Microbial and Anti Viral Potential of Carefully Extracted Emu Oil	UWA-37A	30/11/96	30/06/98	10 000	0	19 352	29 352

Development of Reproductive Technology for Emu Farming	UWA-39A	1/09/97	2/02/00	101 886	28 200	126 082	256 168
NAP-Meeting to Discuss R&D into Emu Meat Processing and Product Development	WS967-17	1/01/97	1/04/97	1 321	—	—	1 321
Emu Farming Research Committee Planning Meeting	WS967-25	10/06/97	30/06/97	2 058	—	—	2 058
Development of Reproductive Technology and Fertility Assessment for the Emu and Ostrich Farming	UWA-52A	15/07/99	30/06/04	284 112	243 540	31 629	559 281
Development and Documentation of a National Language for the Description of Ostrich Meat	AOC-1A	3/01/95	1/03/95	30 000	10 000	12 000	52 000
Development and Documentation of 'Best Practice' Pre Slaughter and Post Slaughter Handling Procedures to Enhance the Natural Tenderness of Ostrich Meat.	AOC-2A	1/12/95	1/02/96	15 574	7 787	—	23 361
Nutritional Needs of Ostriches Under Farming Conditions	DAQ-219A	1/01/97	30/08/00	151 548	19 866	189 205	360 619
Increasing the Hatchability of Ostrich Eggs	DAV-78A	1/08/93	30/06/96	26 500	26 500	11 849	64 849
Reproducing Ostrich Fading Syndrome	DAW-71A	1/01/96	1/09/96	21 443	30 000	11 787	63 230
Reproducing Ostrich Fading Syndrome — Assistance In Development of a PCR	DAW-87A	15/06/97	30/04/98	8 000	0	0	8 000
Ostrich Seminars	MS990-12	—	—	4 000	—	—	4 000
Feasibility Study into the Development of an Ostrich Industry Genetic Recording Scheme	UNE-27A	1/07/92	30/06/93	12 175	11 700	117 000	140 875
Use of Polymerase Chain Reaction to Study Aspergillosis in Ostriches	UNE-37A	1/02/94	31/01/97	18 750	18 750	140 160	177 660
Investigations into the Epidemiology and Diagnosis of Aspergillosis in osTriches	UNE-38A	1/11/93	31/10/96	39 662	39 662	230 586	309 910
Genetic Evaluation for Australian Ostriches — Development of Estimated Breeding Values	UNE-57A	1/07/96	30/07/00	116 939	0	48 569	165 508
Increasing the Hatchability of Ostrich Eggs	UQ-34A	1/08/93	30/09/96	51 605	43 400	19 626	114 631
Pasture Based Management Systems for the Growth of Juvenile (4-12 mths) OstrIches	UT-14A	1/01/97	18/05/99	69 460	51 000	107 915	228 375
A Benchmark Study of Husbandry, Transport, Lairage and Slaughter Methods to Improve the Skin Quality of Ratites	SAR-22A	1/10/99	1/10/00	40 000	7 500	28 015	75 515

Source: RIRDC database and files.

Classification

The projects have concentrated mainly on production issues. This may have been because the industries initially had plenty of momentum gained from the sale of breeding pairs. Reproduction has been an important area of research for both emus and ostriches. Product development has also been an issue;

oils are a potential high value product for emu, while meat and skins are important products for both ratites. Chart 2.11 summarises the classifications.

2.11 **Classification of new animal projects Bird meat and other products**

I II III

Ratities

Industry development

SAR-22A 00
Benchmarks production system for skin quality

Emu

Industry development

DAT-19A 93
Viability of commercial emu farming in Tasmania

Industry development — R&D planning

WS967-25 97
Research Committee Planning Meeting

WS967-17 97
R&D into meat processing

Production

Welfare — code of practice

UF-2A 99
Neuroanatomical and behavioural consequences of declawing

Nutrition — diet

DAT-32A 97
Growth rate and cost factors using cool climate forage

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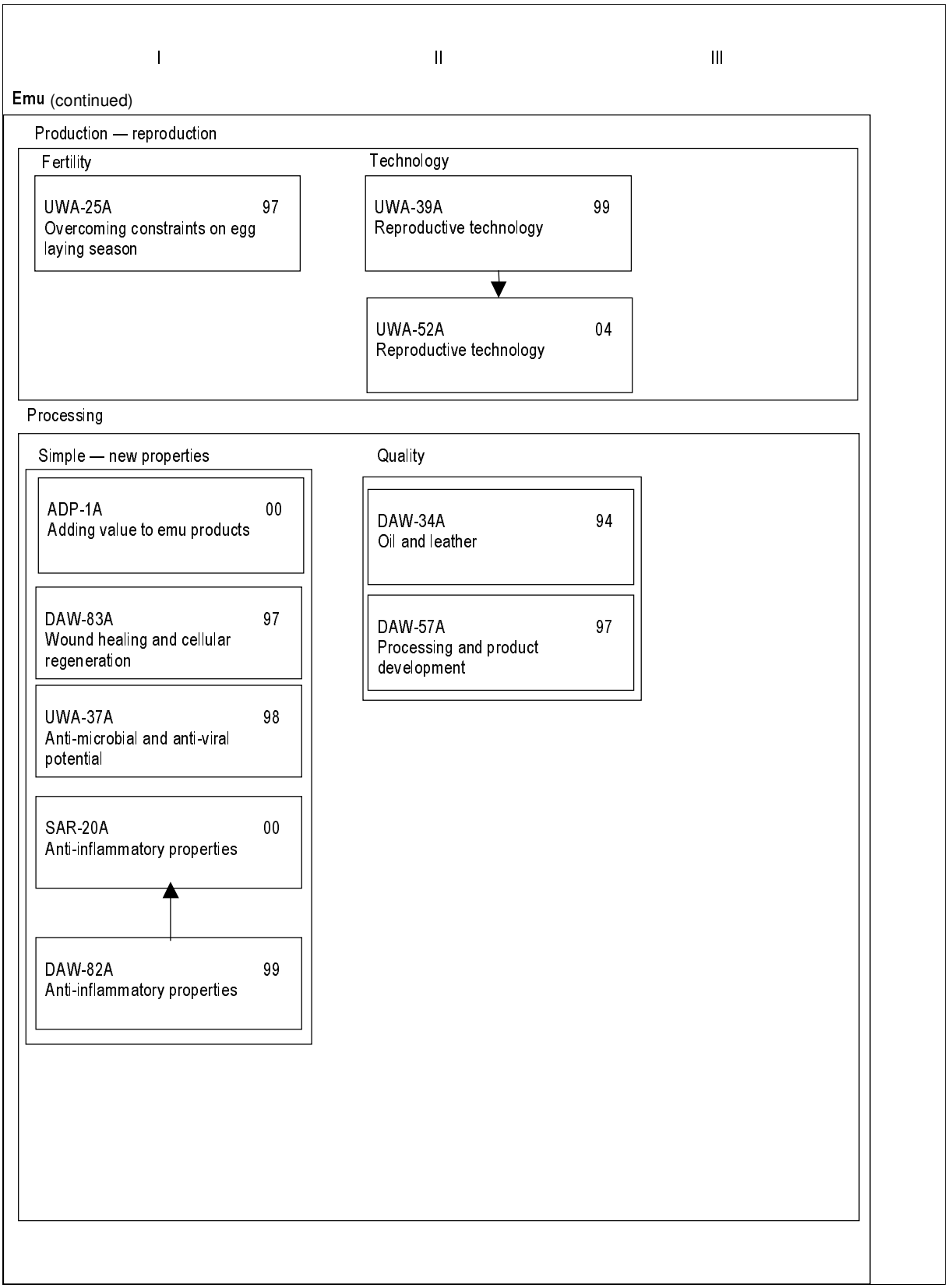
2.11 **Classification of new animal projects Bird meat and other products** (Continued)



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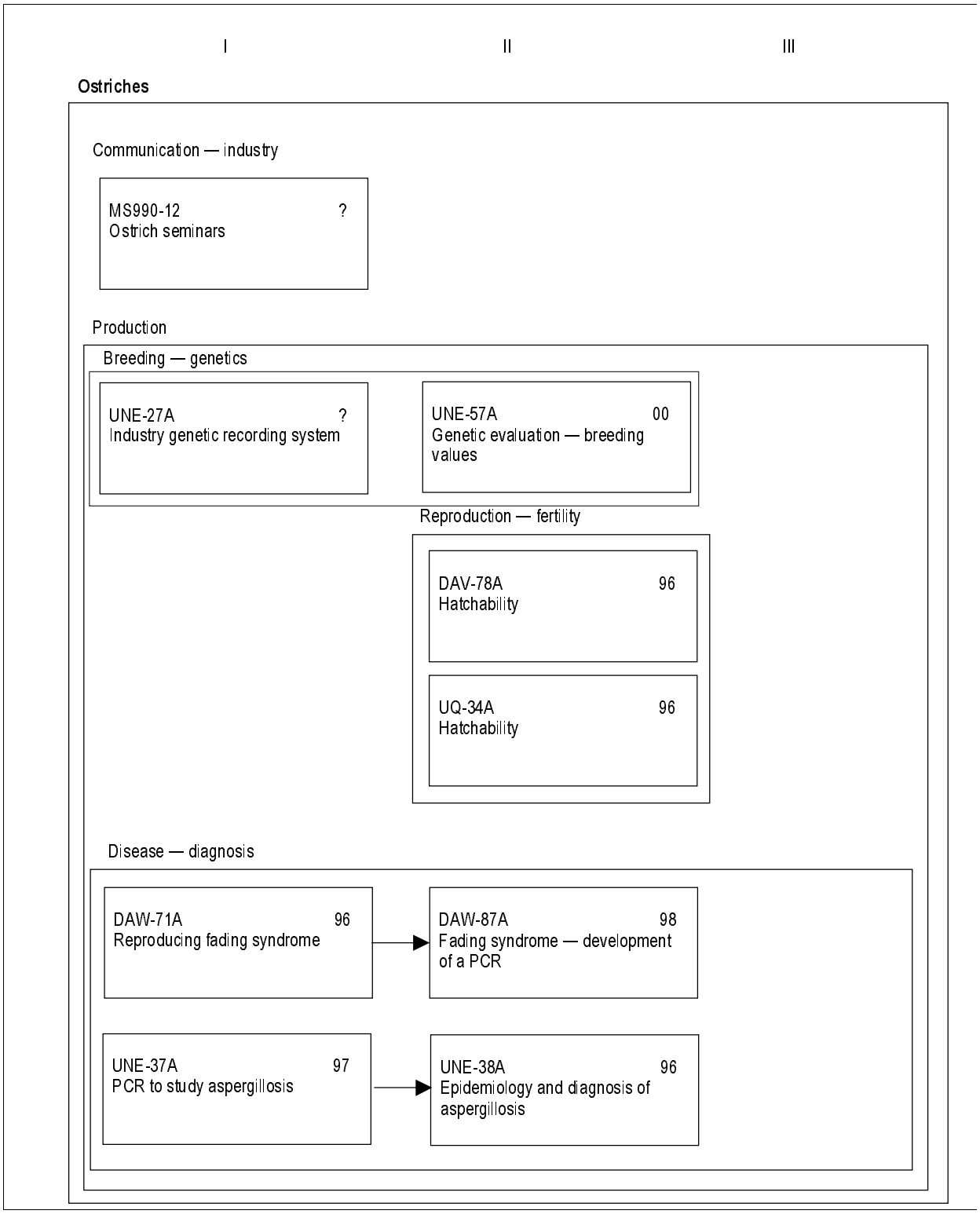
2.11 **Classification of new animal projects Bird meat and other products** (Continued)



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2.11 **Classification of new animal projects Bird meat and other products** (Continued)

I II III

Ostriches (continued)

Production (continued)

Nutrition — diet

DAQ-219A 00
Nutritional needs

UT-14A 99
Pasture based management

Market — quality control

AOC-1A 94
National language for description of ostrich meat

AOC-2A 96
Best practice handling procedures pre and post slaughter

Ducks

Production — nutrition

UQ-76A 00
Self-selection of diets by growing meat-type ducks

Initial assessment

As a set the assessment of the projects are lower than in the meat and skins classification. This less optimistic view of the benefits of the projects may stem from the current relatively depressed outlook for the industries, which have to evolve from a focus on breeding pairs to end products. Again many are too early to assess. Table 2.12 summarises the initial assessment.

Ratites

There are few projects that are relevant to both emus and ostriches.

- SAR-22A *A Benchmark Study of Husbandry, Transport, Lairage and Slaughter Methods to Improve the Skin Quality of Ratites*, is a current project. It is too early to assess the output.
- UWA-52A *Development of Reproductive Technology and Fertility Assessment for the Emu and Ostrich Farming* is discussed under emu as this is the major focus of the project, following on from a current emu project.

Emu

Western Australia was the first state to legalise emu farming in 1987, and was followed by Queensland, Tasmania and New South Wales, and then Victoria in 1994. The national emu population was forecast to be 886 000 birds in 1996, nearly double the 1995 population. However, over the last two years the situation has changed dramatically, with the farm population estimated to be 50 000 in 1999 and for many farmers the costs of keeping and processing the birds far outweigh any revenues raised from them. With the large increase in numbers in the mid-1990s, national throughput increased accordingly, from 14 000 birds in 1992 to 155 000 in 1995. However, with the decline in the population, this number has fallen back to previous levels. The majority of emu meat is sold on the domestic market, but significant quantities are sold to the USA, France, Singapore and the United Kingdom. The value of production of this meat has been put at $3.5 million annually. The markets for oil and skin are seen to have good potential. At present, emu oil production is worth $4.5 million, and is will increase significantly if the therapeutic effects of emu oil are proven.

Projects cover most of the level 1 classifications. Sixteen projects have been undertaken.

2.12 **Initial assessment of new animal projects Bird meat and other products**

Product	*Project*	*Code*	*Stage*	*Level 1*	*Level 2*	*Level 3*	*Evaluation*
Ducks	Self-Selection of Diets by Growing Meat-Type Ducks	UQ-76A	2	Production	Nutrition	Diet	Too early
Emu	NAP-Meeting to Discuss R&D into Emu Meat Processing and Product Development	WS967-17	1	Industry training and development	Development	R&D Planning	High
Emu	Investigation of the Viability of Commercial Emu Farming in Tasmania	DAT-19A	1	Industry training and development	Development	Economic analysis	Low
Emu	Emu Farming Research Committee Planning Meeting	WS967-25	1	Industry training and development	Development	R&D Planning	Low
Emu	Emu Processing And Product Development	DAW-34A	2	Processing	Simple processing	Quality	High
Emu	Emu Product Research — Oil and Leather	DAW-57A	2	Processing	Simple processing	Quality	High

Emu	Determination of the Anti Inflammatory Properties of Emu Oil	DAW-82A	1	Processing	Complex processing	New properties	Low
Emu	Determining the Efficacy of Emu Oil in Wound Healing and Cellular Regeneration	DAW-83A	1	Processing	Complex processing	New properties	Low
Emu	A Preliminary Investigation of the Anti Microbial and Anti Viral Potential of Carefully Extracted Emu Oil	UWA-37A	1	Processing	Complex processing	New properties	Low
Emu	Anti-inflammatory Properties of emu Oil	SAR-20A	1	Processing	Complex processing	New properties	Too early
Emu	Adding Value to Emu Co-products	ADP-1A	1	Processing	Simple processing	New properties	Too early
Emu	Neuroanatomical and Behavioural Consequences of De-clawing in Commercially Farmed Emus	UF-2A	2	Production	Animal Welfare	Code of practice	High
Emu	Investigation of Growth Rate and Cost Factors Affecting Commercial Emu Rearing Using Cool Climate Forage Based Production	DAT-32A	2	Production	Nutrition	Diet	Medium
Emu	Co-ordinated Emu Research Programme — Overcoming the Constraints of the Egg-laying Season	UWA-25A	1	Production	Reproduction	Fertility	Too early/ Medium
Emu	Development of Reproductive Technology for Emu Farming	UWA-39A	2	Production	Reproduction	Technolog y	Too early/ Medium
Emu Ostrich	Development of Reproductive Technology and Fertility Assessment for the Emu and Ostrich Farming	UWA-52A	2	Production	Reproduction	Technolog y	Too early/ Medium
Ostrich	Ostrich Seminars	MS990-12	1	Communication / technology transfer	Industry	Seminars	Too early
Ostrich	Development and Documentation of 'Best Practice' Pre Slaughter and Post Slaughter Handling Procedures to Enhance the Natural Tenderness of Ostrich Meat	AOC-2A	2	Markets	Quality control	Standards	Medium
Ostrich	Development and Documentation of a National Language for the Description of Ostrich Meat	AOC-1A	2	Markets	Quality control	Specificati ons	Medium
Ostrich	Increasing the Hatchability of Ostrich Eggs	DAV-78A	2	Production	Reproduction	Fertility	High
Ostrich	Increasing the Hatchability of Ostrich Eggs	UQ-34A	2	Production	Reproduction	Fertility	High
Ostrich	Pasture Based Management Systems for the Growth Of Juvenile (4-12 mths) Ostriches	UT-14A	2	Production	Nutrition	Diet	Low
Ostrich	Use of Polymerase Chain Reaction to Study Aspergillosis in Ostriches	UNE-37A	1	Production	Disease	Diagnosis	Low/ Medium
Ostrich	Investigations into the Epidemiology and Diagnosis of Aspergillosis in Ostriches	UNE-38A	2	Production	Disease	Diagnosis	Low/ Medium
Ostrich	Reproducing Ostrich Fading Syndrome	DAW-71A	1	Production	Disease	Diagnosis	Medium
Ostrich	Reproducing Ostrich Fading Syndrome — Assistance in Development of a PCR	DAW-87A	2	Production	Disease	Diagnosis	Medium

Ostrich	Feasibility Study into the Development of an Ostrich Industry Genetic Recording Scheme	UNE-27A	1	Production	Breeding	Genetics	Too early
Ostrich	Genetic Evaluation for Australian Ostriches — Development of Estimated Breeding Values	UNE-57A	2	Production	Breeding	Genetics	Too early
Ostrich	Nutritional Needs of Ostriches Under Farming Conditions	DAQ-219A	2	Production	Nutrition	Diet	Too early
Ostrich Emu	A Benchmark Study of Husbandry, Transport, Lairage and slaughter Methods to Improve the Skin Quality of Ratites	SAR-22A	2	Industry training and development	Development	Benchmarks	Too early

Source: RIRDC database and files.

Three projects have focused on industry development.

- DAT-19A *Investigation into the Viability of Commercial Emu Farming in Tasmania* looked at the viability of emu farming in Tasmania. While it concluded that it was viable the industry has since collapsed in Tasmania. The return is judged to be low.
- Two projects have assisted in R&D planning.
  - WS967-17 funded a *NAP-meeting to Discuss R&D into Emu Meat Processing and Product Development.* This workshop set priorities for future research, with projects DAW-34A and DAW-57A resulting, so any evaluation of these projects will need to include this workshop.
  - WS967-25 *Emu Farming Research Committee Planning Meeting* set priorities for emu oil research. These priorities lead to projects SCG-1A (though this project did not go ahead), UWA-37A and DAW-82A and DAW-83A. Any evaluation of these projects would need to include this workshop.

Six projects have looked at aspects of production.

- UF-2A *Neuroanatomical and Behavioural Consequences of De-clawing in Commercially Farmed Emus* was concerned with animal welfare. Declawing of the animals was demonstrated to improve the well-being of the emus as it reduced the damage that they could do to each other while fighting, which they tended to do when enclosed in confined areas. The industry has expressed a wish to adopt a code of practice based on this work. Work on declawing prior to this project was done in projects DAW-34A and DAW-57A, but this project was able to demonstrate the benefits with use of video. The results were widely disseminated and put many farmers' minds at ease over the welfare implications. This allowed declawing to become a widespread practice. The production benefits of declawing are high, so this project is assessed as having high returns.
- One project focussed on nutrition and forage based diets. DAT-32A *Investigation of Growth Rate and Cost Factors Affecting Commercial Emu Rearing Using Cool Climate Forage Based Production* failed to have a major impact as the Tasmanian industry fell apart. The project investigated the use of grazing forage rather than concentrate and confirmed its substitutability. However, as the results of the research are somewhat transferable, the collapse of the industry does not mean that projects have had no impact. It is believed that elements of the Victorian industry have adopted some results.
- Three related projects have looked at aspects of reproduction technology: UWA-25A *Coordinated Emu Research Programme-overcoming the Constraints in the Egg Laying Season*; UWA-39A *Development of Reproductive Technology for Emu Farming;* and UWA-52A *Development of Reproductive Technology and Fertility Assessment for the Emu and Ostrich Farming Have all Concentrated on Raising Fertility*. Together these projects are thought to have a medium payoff. The objective was to improve mating in order to reduce the relative number of males. The research

was done from a strategic perspective and it hasn't been widely adopted, but it's a bit too early to make any judgements.

There are seven projects that have focuses on products from emus. Two have concentrated jointly on oil and leather products, one looked at eggshell properties and four have solely explored the properties of the oil.

- DAW-34A *Emu Processing and Product Development* and DAW-57A *Emu Product Research — Oil and Leather* have been evaluated previously in *Economic Evaluation: Selected New Animal Product Research Projects: RIRDC* and were estimated to have an internal rate of return of 19 per cent. These projects were successful in reducing the cost of production of meat, skins and emu oil. The objectives of this research were to:
  - evaluate markets for emu products, particularly meat and leather;
  - reduce slaughter costs, particularly in the areas of defeathering and skinning;
  - eliminate skin and meat stress damage during transport; and
  - determine the cost of supplying emus for different end uses with particular attention to nutrition levels and composition for different products.

The adoption by industry of the findings has been quite good and the project has also resulted in an income stream to RIRDC, which has to date realised $119 215.

- ADP-1A *Adding Value to Emu Co-products* looks at eggshells and their chemical composition. It is too early to assess the output.
- The four projects analysing emu oil properties are: UWA-37A *A Preliminary Investigation of the Microbial and Anti viral Potential of Carefully Extracted Emu oil*; DAW-82A *Determination of the Anti-Inflammatory Properties of Emu Oil*; DAW-83A *Determining the Efficacy of Emu Oil in Wound Healing and Cellular Regeneration*; and SAR-20A *Anti-Inflammatory Properties of Emu Oil.* The projects have looked mainly at the chemical characteristics of emu-oil to determine if it is anti-inflammatory. This detailed research is required because it is an offence to advertise the anti-inflammatory properties (as emu oil is suspected to have) of products unless they have been properly tested. DAW-82A established a basis for further research, (tests on rats, etc.) DAW-83A came up with a neutral result, with only one sample being anti-fungal. This meant that the researchers were unable to come up with a definite conclusion, so an assessment of the value of the output would probably be low. DAW-83A lead onto SAR-20A that is about ready to start.

Ostrich

The estimated number of ostriches in Australia in 1999 was 150 000, more than half of which were located in the southern states of New South Wales, Victoria and South Australia. The industry began in 1985 and has been growing vigorously. It is estimated that in 2000 meat production will be 800 tonnes worth an estimated $5 million, up from 80 tonnes in 1997. The export market is crucial for this industry as only 5 per cent of production is consumed domestically. However, there have been problems in moving from breeding to commercial production, and this has been exacerbated by international trends and events.

Many of the problems encountered when moving from breeding to commercial production are associated with speculation that kept the value of the birds artificially high. Promoters, who were making attractive claims to investors about the potential returns on investment in ostriches, fueled this speculation. When it was realised that there were limited markets, prices fell, down to zero in some cases with many producers dumping birds to avoid on going feed costs. The market for skins is smaller, with production currently worth $1.1 million a year. Less than 10 per cent of the skins of the slaughtered birds are exported and the rest generally go into storage. However, there have been inquiries from South Africa for the possible purchase of skins since the fall in the South African bird population.

Fourteen projects have been undertaken on ostriches. The main focus has been on solving production problems.

One project has focused on communicating findings to the industry — MS990-12 *Ostrich Seminars.* It is too early to evaluate this project.

Production projects fall into four categories — breeding, reproduction, nutrition and disease.

- There are two breeding projects. UNE-*27A Feasibility Study into the Development of an Ostrich Industry Genetic Recording Scheme* and UNE-57A *Genetic Evaluation for Australian Ostriches — Development of Estimated Breeding Values*. Many producers registered their genetic stock under the first program, but as the industry diminished, interest in this practice was lost. UNE-57A is a current project and has been funded to establish breeding values.

On reproduction, DAV-78A *Increasing the Hatchability of the Ostrich Egg* and UQ-34A *Increasing the Hatchability of the Ostrich Egg* were not well linked but essentially looked at the same thing. There are three stages overall in reproduction rates (fertility, hatchability, early survival) and even a small increase in the success rate for each of these three stages can increase hatchability substantially. Certain findings were quite simple; for example, the wiping of eggs proved to be beneficial. While some of these practices were already well known and used by the better farmers, the potential 30 per cent increases in hatchability that the study found received the publicity needed to ensure that these practices were more widely adopted. Therefore it is considered that these projects have a high pay-off.

- The two nutrition projects are not related.
  - DAQ-219A *Nutritional Needs of Ostriches Under Farming Conditions* is current and too early to evaluate but is going well for growing stock and it is generating spillovers for breeder stock.
  - UT-14A *Pasture Based Management Systems for the Growth of Juvenile (4-12 mths) Ostriches* is assessed as having a low payoff as the commercial partner had to sell his animals due to a decline in the industry. Therefore the project was terminated.
- On disease, two related projects have looked at fading syndrome — DAW-71A *Reproducing Ostrich Fading Syndrome* and DAW-87A *Reproducing Ostrich Fading Syndrome-assistance in Development of a PCR*. These projects focused on developing a treatment, but also improved methods of diagnosis. The project was able to identify the virus and conditions that cause it, and so has led to preventative measures being adopted. However, the benefit from the work on diagnosis and treatment has been limited so far because there has been no further outbreak of the disease. Therefore the payoff is probably medium, but could be higher if another outbreak occurs.
- On disease, two related projects have looked at aspergillosis — UNE-37A *Use of Polymerase Chain Reaction to Study Aspergillosis in Ostriches* and UNE-38A *Investigations into the Epidemiology and Diagnosis of Aspergillosis in Ostriches*. Improved tests were developed as a result of these projects. However they are much more costly than current tests, limiting the projects' value and adoption of their findings.

There were two projects that have looked at quality control to improve marketability of products — AOC-1A *Development and Documentation of a National Language for the Description of Ostrich Meat* and AOC-2A *Development and Documentation of 'Best Practice' Pre Slaughter and Post Slaughter Handling Procedures to Enhance the Natural Tenderness of Ostrich Meat*. Elements of the findings of these reports have been adopted; however, there are calls for a review as there could be problems associated with using some of the procedures. This indicates that the findings of the report could be of mixed benefit, so an evaluation would conclude that the value of this project is medium. An additional aspect to note is that the findings have received some international attention.

Ducks

There is very little information on duck production in Australia, but anecdotally it appears that consumption in the domestic market runs at about 50 000–100 000 ducks per week and growing steadily despite competition from poultry. Due to the favourable climate, production is concentrated in the southern states. Supply is a problem during the peak times of year.

One project has been undertaken to assist the meat duck industry. UQ-76A *Self-selection of Diets by Growing Meat-type Ducks* focuses on production, in particular nutrition. The project looks at new genotypes and their nutritional requirements compared to the traditional genotypes used in Australia. It is too early to assess the impact of this project.

Milk projects

Projects

There have been 13 projects on milk production (table 2.13) from goats and sheep, although one also looked at goat meat production issues. RIRDC funding of over $1.3 million has been provided under this sub-program. The RIRDC funding appears to predominantly have been provided for sheep (over 80 per cent) but this is not an accurate reflection of true contributions as a significant proportion of the funds was a loan rather than a grant.

2.13 **New animal projects timing and cost Milk**

Project	*Code*	*Start date*	*Finish date*	*RIRDC total*	*Industry total*	*Research organisation total*	*Total*
				$	$	$	$
Training in Pasture Management for the Milking Goat Industry	DGS-1A	1/07/96	30/06/97	1 500	—	—	1 500
Phase 2 — Improving Productivity and Specialty Cheese Production in the Australian Dairy Goat Industry	PTP-11A	15/07/98	31/12/00	88 500	14 000	7 500	110 000
Improving Productivity and Specialty Cheese Production in the Australian Dairy Goat Industry	PTP-8A	1/10/97	31/05/98	24 850	4 000	3 000	31 850
Year Round Supply of Goat Milk	UMO-18A	1/07/96	30/06/99	51 775	53 400	18 000	123 175
Increase Autumn and Winter Production of Goat Milk	UMO-24A	1/05/00	30/05/03	46 640	54 140	9 000	109 780
Evaluation of the Awassi Dairy Sheep and its Crosses for Milk, Meat and Wool Production[a]	AWA-1A	1/07/91	30/06/95	395 730	535 385	0	931 115
Investigation and Demonstration of Commercial Scale Management[a] Breeding Procedures for Highly Productive Dairy Sheep (AWASSI)	AWA-2A	1/09/97	30/06/01	336 800	0	692 500	1 029 300
Producing Cheese Products from Sheep's Milk — at Charles Sturt University	MS989-16	17/08/98	30/11/98	12 000	0	0	12 000
The Development of Management Strategies for Improving the Profitability of Sheep Milking	UMO-8A	1/06/92	30/06/95	70 640	70 900	32 700	174 240

Development of Specialty Dairy Products for Sheep Milk to Increase Market Scope	UWA-23A	1/09/94	15/12/98	134 277	179 827	63 271	377 375
Development of Marketable Dairy Products from Sheep Milk	UWA-44A	1/07/98	30/06/01	158 006	469 038	102 586	729 630
Determining the Role of Boer Goat Crosses in the Australian Meat Industry	DAW-80A	30/09/96	30/06/00	5 665	0	320 000	376 665
Specialist Cheese Marketing Analysis	DRD-1A	1/07/96	30/06/97	5 000	—	—	5 000

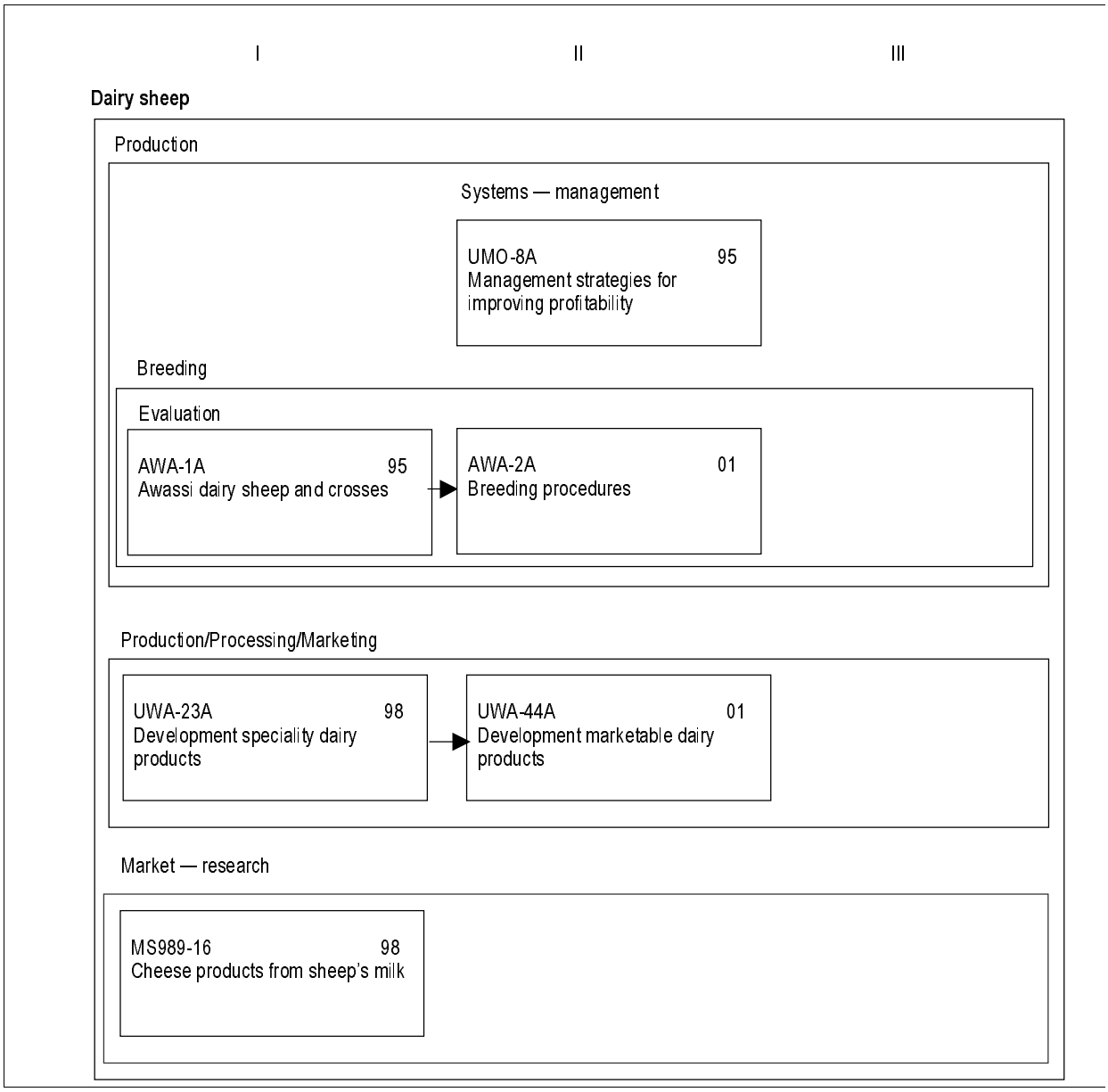
[a] Involved loans as well as direct funding.

Source: RIRDC database and files.

Classification

The main focus of most of the projects has been on production and processing. Production issues centre around nutrition and breeding to improve milk volumes. Processing issues have been market orientated to assess what products are likely to be successful. Chart 2.14 illustrates the types of research being undertaken.

2.14 **Classification of new animal projects Milk**



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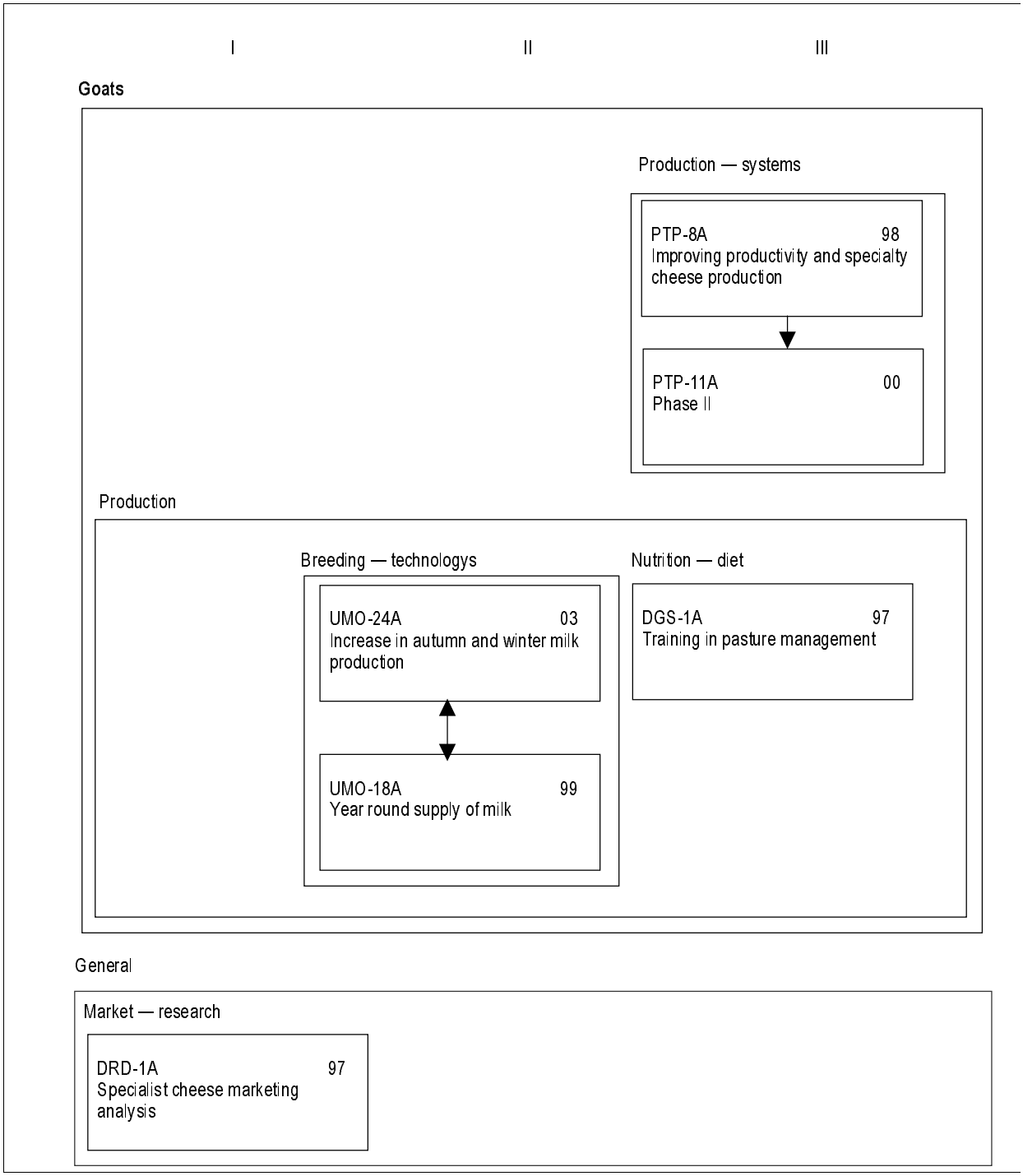
2.14 **Classification of new animal projects Milk** (Continued)



Initial assessment

The overall initial assessment is not very high as the largest projects were assessed as having a low impact. However, as mentioned above, these projects actually involve loans. In general the goat projects are seen as having a greater impact than the sheep projects. Projects that focused more on processing are also seem as having a greater overall benefit. The assessments are summarised in table 2.15.

Dairy sheep

Consumption of sheep milk products is well established but domestic production to meet this demand is only just getting established. In 1994, the farm-gate value of production was $788 640 and Australia imported $5.3 million of sheep milk cheese. Further growth in this industry is needed if critical mass for scale economies is to be achieved.

There are six projects that have looked at dairy sheep. They have a range of objectives.

- UMO-8A *The Development of Management Strategies for Improving the Profitability of Sheep Milking* was an early scoping study. It looked at management and reproduction, but was inconclusive. The report was never published and the impact is judged as low.
- Two projects have evaluated the potential of the Awassi sheep. These are AWA-1A *Evaluation of the Awassi Dairy Sheep and its Crosses for Milk, Meat and Wool Production* and AWA-2A *Investigation and Demonstration of Commercial Scale Management Breeding Procedures for Highly Productive Dairy Sheep (AWASSI).* These projects were conducted with Awassi Australia, and a farm in Cowra that imported Awassi sheep from New Zealand. The benefit from these projects may be severely limited, as access to the genetic stock is restricted to one producer. Some work was undertaken on comparisons with New Zealand crossbred sheep while the sheep were in quarantine. The work was not conclusive and considered unsuccessful. The second project is underway and involves the collection of information such as dairy milk yields of ewes of different genotypes, and milk production and quality implications for different feeding regimes.
- UWA-23A *Development of Specialty Dairy Products for Sheep Milk to Increase Market Scope* and UWA-44A *Development of Marketable Dairy Products for Sheep Milk to Increase Market Scope* are assessed to have a high payoff. The benefits may, however, be limited by the fact that there are only a few producers in this industry so far. The projects look at production and processing, and compare different breeds. There were one or two setbacks due to foot rot being detected in the sheep. This did not prevent research from being completed but it did postpone some of the research. The projects are a good prospect for further evaluation.
- MS989-16 *Producing Cheese Products from Sheep's Milk — at Charles Sturt University* was a small report on market opportunities for the cheese products at Charles Sturt University's cheese factory. Its conclusions did not reveal anything particularly new and weren't published.

Dairy goats

Dairy goat production is well established and is currently in a consolidation period. The industry is still tiny compared to dairy cows. In 1994-95 1.7 million litres of goats milk was produced, a fraction of the 8.2 billion litres produced by cows in Australia. Like dairy cows, the dairy goat industry is concentrated in Victoria. Demand for specialty cheeses has fuelled interest in the industry, while drinking milk is becoming less important due to competition from other low lactose products, such as soymilk. Demand for specialty cheese is well in excess of domestic supply with imports primarily from France. Currently the Australian product can only compete as the premium end of the market due to high production costs relative to France and other major exporters. Investment in this industry has been gradual, contrasting

with the huge capital rush that some other emerging industries, such as emus and ostriches, have experienced. The seasonality of milk supply, disease and lack of superior genetic material are hampering the further development of the industry and research has tended to focus in these areas.

There are five projects all with the objective of improving production. Two focus on management to improve productivity, one on nutrition, and two on reproduction.

- PTP-8A *Improving Productivity and Specialty Cheese Production in the Australian Dairy Goat Industry* and PTP-*11A Phase 2-Improving Productivity and Specialty Cheese Production in the Australian Dairy Goat Industry*, disseminated material through the production of 'Dairy Goat Notes' and by demonstration of best practice. There has been a huge increase in the production of goat milk, from 200 000 L in 1992-93 in Victoria, to 900 000 L in 1998-99. It is hard to say how much of this increase was directly as a result the first of these projects. Nevertheless, the first project is assessed as having a high payoff, and while it is too early to evaluate, the second is also expected to have a high pay-off.
- DGS-1A *Training in Pasture Management* held discussion days on a demonstration site near Melbourne. The results showed that a well-fertilised and managed pasture was superior to existing production systems. It was only a small project but it brought together industry participants who were keen to follow up the project and develop the industry in other ways. This provided the basis for a successful submission for PTP-8A and PTP-11A, so these projects should be evaluated together.
- UMO-18A *Year Round Supply of Goat Milk* and UMO-24A *Increase Autumn and Winter Production of Goat Milk,* are related projects that should be evaluated together. The first project looked at manipulating the reproductive cycle so as to cover the shortfall in the supply of goat milk in autumn and winter, and its oversupply during other parts of the year. This problem has become even more pronounced since the large increase in production. The objective was thought to be quite difficult to achieve, as goats tend only to mate during certain times of year. There were some positive results involving hormonal injections and nutrition, but there has been a lag in the adoption of the practices, so the payoff is estimated to be medium. The second project has not yet commenced.

Only one project has focused on goats for meat production. This project is joint funded by RNF and NAP, MRC. DAW-80A *Determine the Role of Boer Goat Crosses in the Australian Meat Industry* concentrates on production —breeding. It is too early to evaluate the impact of this project.

2.15 **Initial assessment of new animal projects Milk**

Product	*Project*	*Code*	*Stage*	*Level 1*	*Level 2*	*Level 3*	*Evaluation*
Dairy goat	Increase Autumn and Winter Production of Goat Milk	UMO-24A	2	Production	Nutrition/ Breeding	Diet/ Technology	High
Dairy goat	Phase 2 - Improving Productivity and Specialty Cheese Production in the Australian Dairy Goat Industry	PTP-11A	3	Production	Systems	Management	High
Dairy goat	Improving Productivity and Specialty Cheese Production in the Australian Dairy Goat Industry	PTP-8A	3	Production	Systems	Management	High
Dairy goat	Year round Supply of Goat Milk	UMO-18A	2	Production	Nutrition/ Breeding	Diet/ Technology	Medium
Dairy goat	Training in Pasture Management for the Milking Goat Industry	DGS-1A	3	Production	Nutrition	Diet	Too early
Dairy sheep	Producing Cheese Products from Sheep's Milk — at Charles Sturt University	MS989-16	1	Markets	Market research	Opportunities	Low

Dairy sheep	Development of Marketable Dairy Products from Sheep Milk	UWA-44A	2	Processing/ Marketing	Simple Processing/ Market Research	New products/ Opportunities	High
Dairy sheep	The Development of Management Strategies for Improving the Profitability of Sheep Milking	UMO-8A	2	Production	Breeding	Selection	Low
Dairy sheep	Evaluation of the Awassi Dairy Sheep and its Crosses for Milk, Meat and Wool Production	AWA-1A	1	Production	Breeding	Evaluation	Low/ Medium
Dairy sheep	Investigation and Demonstration of Commercial Scale Management Breeding Procedures for Highly Productive Dairy Sheep (AWASSI)	AWA-2A	2	Production	Systems	Management	Low/ Medium
Dairy sheep	Development of Specialty Dairy Products for Sheep Milk to Increase Market Scope	UWA-23A	1	Production/ Processing/ Marketing	Pre-harvest production systems/ Simple Processing/ Market Research	Husbandry/ New products/ Opportunities	High
Goat	Determine the Role of Boer Goat Crosses in the Australian Meat Industry (joint funded RNF and NAP, MRC)	DAW-80A	1	Production	Breeding	Evaluation	Too early
Dairy sheep/ goats	Specialist Cheese Marketing Analysis	DRD-1A	1	Markets	Market research	Domestic	Medium

Source: RIRDC database and files.

General

One project DRD-1A *Specialist Cheese Marketing Analysis* is relevant to both dairy sheep and goats. The project provided a confidential report to industry members and was funded jointly with the Dairy Research and Development Council (DRDC). It was a benchmark report looking at the current industry status, the constraints that producers faced and potential markets, for example, Japan. It might have had some impact and the value is judged to be medium.

Other projects

Industry status and prospects

Projects

There are 11 other projects that do not fit into the classifications described above. While mainly feasibility studies, several early alpaca projects are also included. Alpaca research is now funded under the emerging industry program on rare and natural animal fibres. Table 2.16 summarises the projects.

2.16 **New animal projects timing and cost Other**

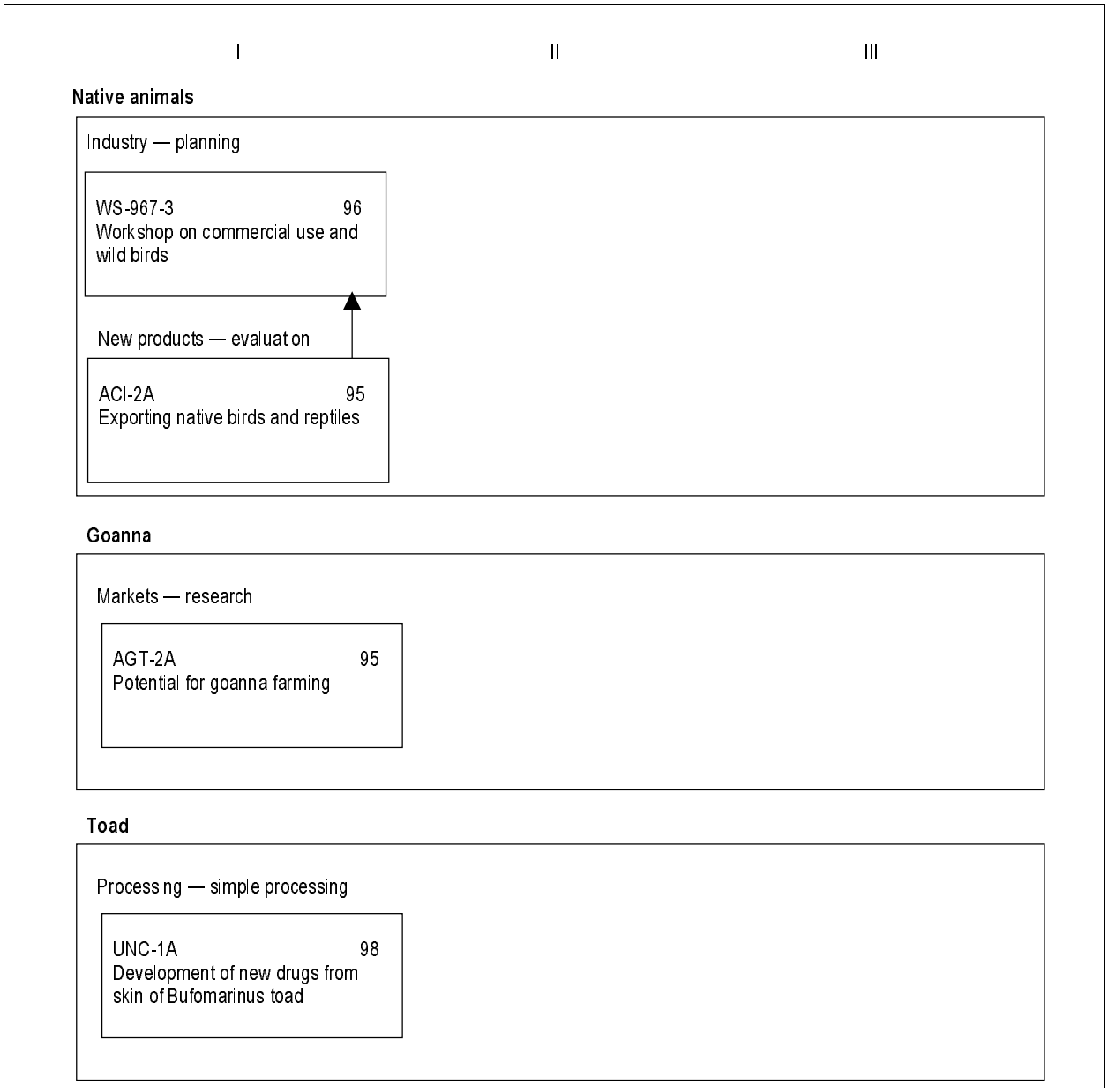
Project	*Code*	*Start date*	*Finish date*	*RIRDC total*	*Industry total*	*Research organisation total*	*Total*
				$	$	$	$
Productivity and Marketing Improvement of the Alpaca Fibre Industry in Australia	DAS-41A	1/07/94	30/06/98	167 467	405 000	93 108	665 575
The Peruvian Alpaca Industry	TUC-1A	—	—	10 000	—	—	10 000
Planning and Coordination Workshop on the RIRDC Project on the Commercial Use of Wildbirds	WS967-3	11/09/96	23/09/96	3 036	—	—	3 036
Business Plan for Freshwater Crayfish as Complementary to Existing Animal Products	CSU-2A	15/07/99	30/06/00	14 996	4 000	13 859	32 855
Technology Information to Enable the Development of Earthworm Production	CSA-6A	15/07/98	30/11/01	154 131	125 000	178 761	457 892
A pre-feasibility Study of the Potential for Goanna Farming in Australia	AGT-2A	1/07/94	30/06/95	43 050	—	16 000	59 050
Economic Potential of Llama Farming in Australia	EE-1A	1/07/89	30/10/89	18 480	—	18 480	36 960
Exporting Australian Native Birds and Reptiles	ACI-2A	1/10/94	30/06/95	50 000	—	7 180	57 180
Potential for Silkworm Production in Australia	UQ-77A	1/07/98	30/06/99	15 000	0	7 200	22 200
Breeding and Growing Snails on a Commercial Level in Australia	AHR-1A	15/07/99	1/03/00	13 900	0	2 000	15 900
The Chemical Extraction, Pharmacological Evaluation and Development of Novel Drugs from the Skin of the Bufo marinus Toad	UNC-1A	3/01/95	5/01/98	105 763	7 500	28 100	141 363

Source: RIRDC database and files.

Classification

The classification of the projects is illustrated in chart 2.17.

2.17 **Classification of new animal projects Other**



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2.17 **Classification of new animal projects Other** (Continued)

I II III

Silk worm

Markets — market research

UQ-77A 99
Potential for silkworm production

Snails

Industry — development

AHR-1A 00
Breeding and growing snails on a commercial level

Earthworm

Production — systems

CSA-6A 01
Technology information to enable the development of earthworm production

Crayfish

Industry — development

CSU-2A 00
Business plan for freshwater crayfish as complementary to existing animal products

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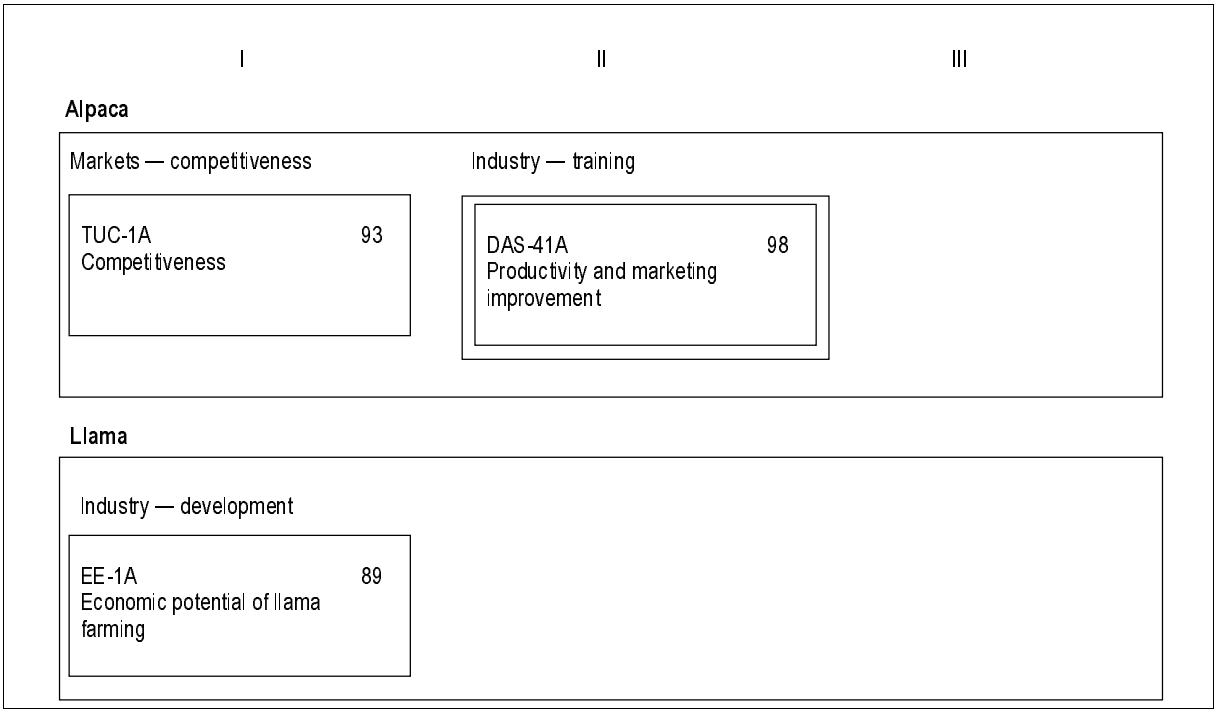
2.17 **Classification of new animal projects Other** (Continued)



Initial assessment

Fibre

Australia has the second largest Alpaca population in the world, and with room to expand, has a significant advantage over South American competitors. Currently the industry is focussed on breeding, but a sustainable industry will be based of fleece production. The critical mass of the industry is estimated to be a population of 200 000 alpacas producing over 900 tonnes of fibre annually. This compares to the 1998 production of 70 tonnes from an estimated population of 20 000. There are export opportunities for live animals as many countries are unwilling to buy from South America. In 1996, alpacas worth $15 million were exported to Canada.

Alpaca has been moved to rare and natural animal fibres, but some projects are being funded under the new animal program. This is the situation for the budgeting software project where there are considerable overlaps with other new animal industries. There are two sets of projects that can be classified under fibres.

- *Alpaca* — TUC-1A funded travel to Peru to study the *Peruvian Alpaca Industry*. It was very useful as it laid the foundations for a good proposal for DAS-41A, so these should be evaluated together. It studied production systems, disease, harvesting and constraints and their relevance to Australia. DAS41-A *Productivity and Marketing Improvement of the Alpaca Fibre Industry in Australia*, was a benchmark study done on five commercial properties. It was very extensive, looking at all production systems, including levels of biochemical parameters and parasites, of which little was known at the time. The results were a highlight of a subsequent conference and were disseminated quickly. This project has been evaluated in the *Economic Evaluation: Selected New Animal Research Projects: RIRDC*. It was estimated internal rate of return of this project was 34 per cent.

- *Llama* — EE-1A *Economic Potential of Llama Farming in Australia* was an early project. The report found that the prospects for a llama industry in Australia were low and that it was best suited to being a companion animal. The absence of a llama industry in Australia at the moment suggests that either the advice was taken or the industry would not have developed anyway. It is difficult to assess the benefits of the project as it might have prevented any wasteful investment. However, the payoff is most likely to be low.

Native animals

Australia is currently opposed to the export of native birds. However it is estimated that $50 million are smuggled out of the country each year. In comparison, Papua New Guinea has had a very successful Parrot Exporting Facility operating. Domestic trade is not prohibited and is judged to have considerable potential for continued growth.

There have been three projects that have focused on native birds and animals.

- ACI-2A *Exporting Australian Native Birds and Reptiles* is evaluated as a low return project. The report concluded that you could relax the restrictions on the export of native birds and reptiles and work on management plans. However, the market is likely to become saturated and that this would dramatically reduce the export price and therefore the benefit. The findings have not yet been acted upon.
- WS967-3 was a workshop that followed on from ACI-2A. This workshop was an input to policy considerations on this issue, which are still being debated in the federal government.

Goanna

One project has looked at the feasibility of goanna farming. AGT-2A *A Pre-feasibility Study of the Potential for Goanna Farming in Australia* looked at the legal, technical and financial aspects of the production of goannas. Legal and technical considerations were found to be sound but financial aspects are not viable. The report could have prevented wasted investment so is assessed as a medium return.

Toad

Secretions of the *Bufo marinus* toad are suspected of having medicinal properties. UNC-1A has funded research into the *Chemical Extraction, Pharmacological Evaluation and Development of Novel Drugs from the Secretions of the Bufo marinus Toad*. The University of Newcastle as a result of this research patented a bioassay. While firm results have not yet been established, that the University of Newcastle went to the effort of patenting the bioassay suggests that there could be considerable value in the findings. Moreover, there have been inquires from China about the assay, so the return on the project is assessed as medium to high.

Crayfish

Normally freshwater and marine animal industry research is conducted by the Fisheries Research and Development Corporation. AWC-1A *Business Plan for Freshwater Crayfish as Complementary to Existing Animal Products* has been funded by RIRDC largely because of its focus on use of water for livestock production. The role of the RIRDC funded research is to look at marketing aspects while the CSIRO has responsibility for the scientific aspects of the research. It has just started so it is too early to evaluate.

Silkworm

UQ-77A looks at the *Potential for Silkworm Production in Australia*. The focus is on markets for production and potential competitiveness. It is too early to assess the likely outcome of this project.

Snails

AHR-1A explores the economic viability of *Breeding and Growing Snails on a Commercial Level in Australia*. It is too early to assess the outcome of this project.

Earthworm

One project that examines technical production issues in nutrition has been funded — CSA-6A *Technology Information to Enable the Development of Earthworm Production*, which is aimed at making a meal from worms. The motivation for the project is that meat meal is banned for feeding to ruminants and may be banned for non-ruminants as a result of concerns arising from mad cow disease. While the production issues are being addressed well by the research, some commercial partners have ceased to participate in the project due to financial difficulties. It is too early to say what the outcome will be.

Table 2.18 summarises the initial assessment.

2.18 **Initial assessment of new animal projects Other**

Product	*Project*	*Code*	*Stage*	*Level 1*	*Level 2*	*Level 3*	*Evaluation*
Alpaca	Productivity and Marketing Improvement of the Alpaca Fibre Industry in Australia	DAS-41A	2	Industry training and development	Training	Marketing	High
Alpaca	The Peruvian Alpaca Industry	TUC-1A	1	Markets	Competitive-ness	Competitors	High
Birds	Planning and Coordination Workshop on the RIRDC Project on the Commercial Use of Wildbirds	WS967-3	1	Industry training and development	Development	Industry planning	Too early
Crayfish	Business Plan for Freshwater Crayfish as Complementary to Existing Animal Products	CSU-2A	2	Industry training and development	Development	Industry planning	Too early
Earthworm	Technology Information to Enable the Development of Earthworm Production	CSA-6A	2	Production/ Processing	Systems/ Simple Processing	Management/ New products	Too early
Goanna	A Pre-feasibility Study of the Potential for Goanna Farming in Australia	AGT-2A	1	Markets	Market research	Opportunities	Medium/ High
Llama	Economic Potential of Llama Farming in Australia	EE-1A	1	Industry training and development	Development	Economic analysis	Low
Native animals	Exporting Australian Native Birds and Reptiles	ACI-2A	1	Markets	Market research	Opportunities	Low
Silkworm	Potential for Silkworm Production in Australia	UQ-77A	1	Markets	Market research	Opportunities	Too early
Snails	Breeding and Growing Snails on a Commercial Level in Australia	AHR-1A	1	Industry training and development	Development	Economic analysis	Too early

Toad	The Chemical Extraction, Pharmacological Evaluation and Development of Novel Drugs from the Skin of the Bufo marinus Toad	UNC-1A	1	Processing	Simple processing	Medicines	Medium/ High

Source: RIRDC database and files.

Further evaluation

Three groups of projects were recommended for a benefit cost assessment.

- The project on kangaroos, AM-4A *Kangaroo Meat Trading Language and Specification Manual,* which developed a manual setting out the meat cuts for kangaroo is evaluated in stage 2 of the report. It was initially assessed as having a very high return and this was confirmed by the evaluation.
- A series of six projects on crocodiles that set up and conducted research on production of crocodiles was evaluated. The projects are:
  - *DAQ-114A, Support for Crocodile Farming: Intensive Tropical Animal Production,*
  - *DAQ-220A, Designing a Research Facility for Grower Sized Crocodiles*
  - *DAQ-188A Crocodile Farming: Research, Development and On-farm Monitoring,*
  - *DAQ-132A Crocodile Farming in Queensland: Research into Husbandry Practices,*
  - *DAQ-229A Electrical Restraining and Stimulation of Crocodile.*
  - *DAQ-247A Improved Nutrition and Management of Farmed Crocodiles: Hatching to Harvest.*

  These projects received mixed initial assessments, with the first two assessed as having a high return, in that they were required for further research to occur. Electrical restraining was also seen as a project with a good impact. Given the difficulty attributing outcomes to the different projects the projects were assessed as a unit. They were found to have a low return mainly due to the long lag between the major investment in the facility and the adoption of research findings. Of the individual projects the electrical restraining project would have a high return.
- Two dairy goat projects UMO-18A *Year Round Supply of Goat Milk* and UMO-24A *Increase Autumn and Winter Production of Goat Milk* that worked to lower production costs were evaluated. They were found to have a good return on the investment, justifying the classification of high impact.

3. New plant products

Overview

Sub-program objectives

The new plant product program was formally established in 1993. Currently 55 projects are under way and 212 projects have been undertaken since the inception of the sub-program. The objective of the sub-program is to facilitate the development of new industries based on plants or plant products that have commercial potential for Australia. The key strategies for 1998-99 were to:

- support preliminary market studies and technical feasibility studies;
- identify, evaluate, test market and develop species, varieties, processes or products with prospects of commercial viability;
- develop integrated production, harvesting, processing and marketing systems; and
- foster the development of policy, infrastructure and R&D plans and initiatives to underpin industry growth.

Program areas

There are six main areas in the program under which projects can be classified. Their main products and farm gate value estimates (Evans, personal communication) are given.

- Bushfoods
- Culinary herbs, spices and beverages
- Extractive and fibre crops
- Prospective fruit, vegetable and nut crops
- Prospective grain and pulse crops.
- Miscellaneous crops and activities support industry wide activities as well as some products that fall outside the other areas.

Funding

The annual budget of the program has been around $1 million, with an increase in 1999-2000 to $1.5 million. The program now includes the former Herbs, Spices and Tea and Coffee program and the Cashew program. Since the establishment of the program RIRDC has contributed (or committed) $15.6 million. This has been enhanced by industry contributions of $9.8 million and research organisation contributions of $22.0 million.

Table 3.1 summarises the expenditure on research in each of these categories, and their major sub categories since the inception of the program.

3.1 **Total and share of expenditure by subcategory**

	Number of projects	*RIRDC total funding*	*Industry total funding*	*Research organisation total funding*	*Total*	*RIRDC*
		$	$	$	$	%
Bushfood	15	712 538	196 578	821 977	1 731 092	41

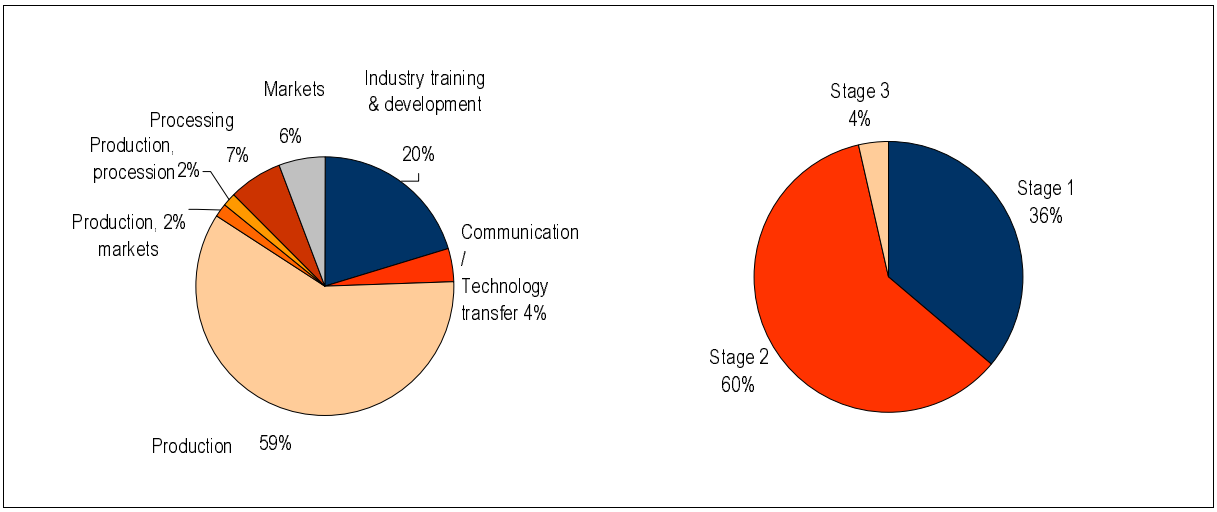
Culinary herbs and spices	22	1 564 696	1 077 567	1 695 444	4 337 706	36
Beverages	22	1 704 032	750 948	1 301 499	3 756 479	45
Extractive crops	36	2 359 413	3 207 735	3 820 133	9 387 281	25
Fibre crops	5	109 000	0	30 000	139 000	78
Fruits	29	2 521 741	752 002	5 125 099	8 398 842	30
Vegetables	7	420 720	975 920	401 082	1 797 722	23
Nuts	26	2 884 210	767 463	3 659 178	7 310 851	39
Grain and pulse	27	1 757 820	580 976	3 145 537	5 484 333	32
Miscellaneous	20	1 587 466	1 459 783	2 032 815	5 080 064	31
Total	**209**	**15 621 636**	**9 768 972**	**22 032 763**	**47 423 370**	**33**

Source: RIRDC database and files.

Types of research

As outlined in chapter 1 research can be categorised by the point of the value chain where it is directed as well as the research activities undertaken. It can also be categorised by the stage of product development. Chart 3.2 gives the share of RIRDC funding allocated by each of these classifications. It shows the emphasis of the overall program on where in the value chain R&D occurs and the stage of development. As expected in the new industry portfolio, the majority of projects are in stage I, however, in dollar terms the majority of spending is in stage II of product development.

3.2 Share of RIRDC funding allocated by level 1 and stages of development

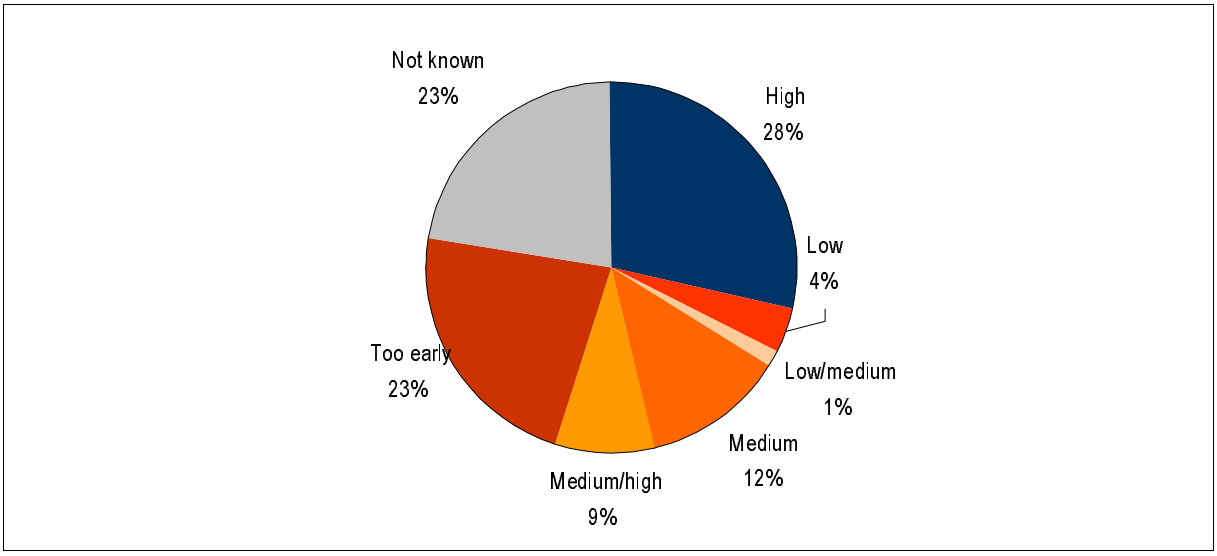


Data source: RIRDC database, compendiums.

Initial assessment

Overall the program is judged to have performed well. Chart 3.3 summarises the outcome of the initial assessment.

3.3 Initial assessment for the new plant program



Data source: RIRDC database, compendiums.

Details of the projects are provided below, by sub-category.

Bushfoods

Projects

The bushfood industry is relatively small, with a farm gate value of around $5 million. It is a mix of cultivated plants and wild harvest. Around 20 species are traded, the main being bush tomato, lemon myrtle, quandong, warrigal greens and wild lime. Profitability is reportedly low. There are, however, several companies that are creating niche markets for their products. (Evans, January 2000).

There have been 15 projects undertaken that are classified as bushfoods. The total cost of these projects is $7 million, of which 41 per cent has been funded by RIRDC. Most projects date from the feasibility study and seminar in 1996. The projects are listed in table 3.4.

3.4 Projects — timing and funding Bushfood

Project	*Code*	*Start date*	*Finish date*	*RIRDC total*	*Industry total*	*Research organisation total*	*Total*
Food Safety of Australian Plant Bushfoods	AGP-1A	15/01/98	31/12/00	68 000	10 000	33 600	111 600
Genetic and Agronomic Improvement of Quandong	AQI-1A	6/05/99	30/05/03	9 000	8 640	2 300	19 940
Bushfood Industry Database Scoping Study	AQU-1A	2/02/98	31/07/98	35 000	—	—	35 000
Marketing the Australian Bushfood Industry	BUS-1A	2/02/98	30/05/99	45 000	14 950	27 355	87 305
Innovative Products from Indigenous Australian Bushfoods	CFO-1A	15/02/99	31/01/02	150 000	11 877	464 100	625 977
Cultivation and Sustainable Wild Harvest of Bushfoods by Aboriginal Communities in Central Australia	CLC-1A	1/09/99	31/08/02	132 000	—	95 670	227 670
Evaluating Performance of Cultivated Bushfood Plants in South Australian Environments	CSL-11A	1/01/00	1/01/04	137 234	135 111	73 851	346 196

Establishment of an Economically Viable & Ecologically Sustainable Bushfood Industry in Australia's Northern Rangelands: Phase 1 Desktop Pre-feasibility Study	DAQ-189A	—	30/06/96	10 000	5 000	9 702	24 702
The Prospects of Commercialising Indigenous Boab Tubers as Vegetables	DAW-95A	1/02/99	30/06/94	15 000	5 500	17 889	38 389
Bush Food Seminar	GRA-1A	13/01/99	—	1 000	—	—	1 000
Investigation into Safety and Food Values of Certain Prostanthera Species	NMT-1A	2/06/99	31/12/99	10 000	4 000	2 000	16 000
Australian Native Bushfoods — Processed Product Potential Including Cost Evaluation	RPT-1A	1/09/96	9/12/96	35 000	—	—	35 000
Development of an Integrated Pest Management Program (IPM) for the Control of Quandong Moth in Quandong Orchards	SAR-4A	1/06/97	30/06/01	39 000	1 500	95 510	136 010
Bushfoods R&D Planning Workshop — 24 February 1997	WS967-14	24/02/97	24/02/97	22 437	—	—	22 437
2nd Bushfood R&D Plan	WS978-17	1/12/97	1/05/98	3 867	—	—	3 867

Source: RIRDC database and files.

Classification

The projects are distributed across the various categories. The early projects tended to be more focused on industry development. This was followed by an emphasis on markets, and the most recent projects are on production and processing issues. The classification is illustrated in chart 3.5, which shows the links between projects, and summarised in table 3.6.

Initial assessment

The initial assessment is based on the program manager's judgement of the outcome of the project. A summary of each project group, as set out in chart 3.5 is provided in table 3.6. Most of the projects undertaken have been applicable across the range of products in the bushfood industry, only a few have focused on specific products.

Industry training and development

- WS967-14, *Bushfoods R&D Planning Workshop*, and WS978-17 *2nd Bushfood R&D Plan* brought together members of the industry in order to identify the problems facing them and to establish R&D priorities. Such things as food safety and information systems were discussed. The outcome of this project was an R&D plan and the establishment of the R&D Advisory Panel. All current projects are a result of this workshop so the impact would be high.

3.5 **Bushfood**

General

Industry — development

R&D planning

WS967-14 97

Bushfood R&D planning workshop 26 Feb 1997

WS978-17 98

Second bushfood R&D plan

Economic analysis

DAQ-189A 96

Establishment of an economically viable and ecologically sustainable bushfood industry in Australia's northern rangelands: Phase 1 desktop pre-feasibility study

Industry

Development industry planning

GRA-1A 99

Bushfood seminar

General

Processing — complex

CFO-1A 02

Innovative products from indigenous Australian bushfoods

(Continued on next page)

3.5 **Bushfood** (Continued)

I II III

General

Production — systems

Management

CSL-11A 04

Evaluating performance of cultivated bushfood plants in South Australian environments

CLC-1A 02

Cultivation and sustainable wild harvest of bushfoods by Aboriginal commonities in Central Australia

Markets — quality control

Quality control

Food safety

AGP-1A 00

Food safety of Australian plant bushfoods

Descriptions

AQU-1A 98

Bushfood industry database scoping study

Market research opportunities

RPT-1A 96

Australian native bushfoods — processed product potential including cost evaluation

BUS-1A 99

Marketing the Australian bushfood industry

(Continued on next page)

3.5 **Bushfood** (Continued)

I II III

Quandong

Production

Pest/weed — IPM

SAR-4A 01

Development of an integrated pest management program (IPM) for the control of quandong moth in quandong orchards

Breeding — genetic

AQI-1A 03

Genetic and agronomic improvement of quandong

Prostanthera

Market — quality control

NMT-1A 99

Investigation into safety and food values of certain prostanthera species

Boab tubers

Industry — development

DAW-95A 94

The prospects of commercialising indigenous boab tubers as vegetables

3.6 Projects — classification and initial assessment Bushfoods

Project	*Stage*	*Level 1*	*Level 2*	*Level 3*	*Code*	*Evaluation*
Food Safety of Australian Plant Bushfoods	1	Markets	Quality control	Food safety	AGP-1A	High
Genetic and Agronomic Improvement of Quandong	2	Production	Breeding	Genetic	AQI-1A	Too early
Bushfood Industry Database Scoping Study	1	Markets	Quality control	Descriptions	AQU-1A	High
Marketing the Australian Bushfood Industry	1	Markets	Market research	Opportunities	BUS-1A	High
Innovative Products from Indigenous Australian Bushfoods	1	Processing	Complex	New properties	CFO-1A	Too early
Cultivation and Sustainable Wild Harvest of Bushfoods by Aboriginal Communities in Central Australia	2	Production	Systems	Management	CLC-1A	Too early
Evaluating Performance of Cultivated Bushfood Plants in South Australian Environments	1	Production	Production systems	Management	CSL-1A	Too early
Establishment of an Economically Viable & Ecologically Sustainable Bushfood Industry in Australia's Northern Rangelands: Phase 1 Desktop Pre-feasibility Study	1	Industry training and development	Development	Economic analysis	DAQ-189A	Medium/high
The Prospects of Commercialising Indigenous Boab Tubers as Vegetables	1	Industry training and development	Development	Economic analysis	DAW-95A	Too early
Bush Food Seminar	3	Industry training and development	Development	Industry planning	GRA-1A	High
Investigation into Safety and Food Values of Certain Prostanthera Species	2	Markets	Quality control	Food safety	NMT-1A	Medium to high
Australian Native Bushfoods — Processed Product Potential Including Cost Evaluation	1	Markets	Market Research	Opportunities	RPT-1A	High
Development of an Integrated Pest Management Program (IPM) for the Control of Quandong Moth in Quandong Orchards	2	Production	Pest/weed	IPM	SAR-4A	Too early
Bushfoods R&D Planning Workshop — 24 February 1997	1	Industry training and development	Development	R&D Planning	WS967-14	High
2nd Bushfood R&D Plan	1	Industry training and development	Development	R&D Planning	WS978-17	High

Source: RIRDC database and files.

- DAQ-189A *Establishment of an Economically Viable & Ecologically Sustainable Bushfood Industry in Australia's Northern Rangelands: Phase 1 Desktop Pre-Feasibility Study* investigated the potential of the small bushfood industry in Queensland. It undertook a preliminary market analysis; gathering information on the distribution and abundance of species and reviewing recently published material. The project found that there is potential for a 10-fold increase in the industry, but this requires a coordinated approach involving the public and private sectors. It was useful and findings have been quoted in workshops and other forums. The impact is assessed as medium/high.
- GRA-1A *Bushfood Seminar* reviewed the existing industry on the north coast of New South Wales. It considered current issues facing the industry and planning for future growth and development. The seminar identified information exchange and access as a major priority, and support was given for the establishment of a Regional Association and National Network. A Steering Committee was elected to develop and implement an action plan arising from the seminar. A useful volume of papers was presented, with 200 people in attendance. It is assessed as having a high impact.

Production

Two projects are looking at management of production. They are not related.

- CSL-11A *Evaluating Performance of Cultivated Bushfood Plants in Southern Australian Environments* will provide information on quality of produce from selected species as well as some training. It has just commenced so it is too early to evaluate.
- CLC-1A *Cultivation and Sustainable Harvest of Bushfoods by Aboriginal Communities in Central Australia* is investigating the horticultural requirements of bushfoods and reviewing its sustainability to aid Aborigines. This project has only just begun so is too early to evaluate.

Processing

CFO-1A *Innovative Products from Indigenous Australian Bushfoods* is looking at issues such as post-harvest shelf-life, flavour, application/product development, etc. of alternative products from bushfoods. It has just started so it is too early to evaluate.

Markets

- Several projects have looked at issues of quality control.
  - AGP-1A *Food Safety of Australian Plant Bushfoods* looks at detailing the factors that may be a health hazard in Australian bushfoods. The project was a result of the Bushfood Workshops mentioned earlier. Is expected to have a high impact.
  - AQU-1A *Bushfood Industry Database Scoping Study* aimed to provide descriptions of products to enhance quality of production and inform consumers. Information failure was identified in the Bushfood Workshops as a significant impediment to the development of this industry. This project provided a detailed definition of user requirements of an industry database, and a database design and development strategy. The project came to the conclusion that a single database was not viable or practical. What was suggested was a network of smaller databases (some of which already exist) linked through the Internet. This is going to occur and discussions are occurring with industry for RIRDC to provide this service.
- There have been two market research projects.
  - RPT-1A *Australian Native Bushfoods-Processed Product Potential Including Cost Evaluation* aimed to evaluate prospects for the bushfood industry. This information would provide a sound basis for identifying and prioritising industry research and development. The final report contained the most current and complete base line study for bushfoods to date. Information on plant species viability, current raw product demand, industry research and development requirements, industry opportunities and constraints was provided. It is an important source of information for people wanting to join the industry, those in the industry, and also for RIRDC in prioritising research. It is judged to have had a high impact.
  - BUS-1A *Marketing the Australian Bushfood Industry* focused on market opportunities. Concern exists for the future of the industry with over-supply and business closures. Also, the Olympics are seen as an opportunity to market bushfood and develop contacts into other countries as well as the domestic market. Interviews were conducted with influencer (chefs and food media) and consumer groups. The final report is nearly completed, but the draft report has been widely disseminated. This report indicated that there was more market potential for native ingredients if appropriate strategies are used, for example using the word 'Australiana' instead of 'bushfood' or 'bush tucker'. The findings have been useful and extension has been excellent, so it has had a high impact.

Quandong

Two recent projects are focusing on production issues in quandong, a native fruit.

- SAR-4A *Development of an Integrated Pest Management Program (IPM) for the Control of the Quandong Moth in Quandong Orchards* is in progress and appears to be progressing well.
- AQI-1A *Genetic and Agronomic Improvement of Quandong* is a small project in progress. The quandong is a parasite so needs a host. This project is investigating the use of acacia as the host and also attempting some genetic improvement in the quandong.

Prostanthera

NMT-1A *Investigations into Safety and Food Values of Certain Prostanthera Species* has just been completed. It has looked at food safety of three species of native mint and has provided enough information to form the basis of food standards, and should therefore have a medium to high impact.

Boab tubers

The boab tuber is a bushfood and has been identified as having some potential. DAW-95A *The Prospects of Commercialising Indigenous Boab Tubers as Vegetables* is an overall assessment of this potential, consisting of a market study, and looking at things such as techniques for growing it. It is too early to judge what sort of impact it might have had.

Culinary herbs and spices and beverages

Projects

The culinary herb industry is one of the larger industries in the sub-program, with a farm gate value of around $25 million. The fresh herb sector is dominant, with dried herbs and pastes competing with imported product. Spices are currently very small sector, with most imported from low labour cost countries. (Evans, January 2000)

Beverages — coffee, tea and cocoa — are largely imported and the Australian industry is relatively small. Coffee is a growing industry, with a farm gate value of around $1.2 million in Far North Queensland, and $1 million in Northern New South Wales. Green tea is yet to be commercially produced, while black tea has a farm gate value of around $1.7 million. Cocoa is at the feasibility assessment stage, with no significant commercial production.

There have been 47 projects undertaken that are classified as culinary herbs, spices and beverages. Beverages make up 22 of these projects. The total cost of these projects is $8 million of which 40 per cent has been funded by RIRDC. The projects are listed in table 3.7.

3.7 **Projects — timing and funding Culinary herbs and spices and beverages**

Project	*Code*	*Start date*	*Finish date*	*RIRDC total*	*Industry total*	*Research organisation total*	*Total*
Review of the Prospects for the Australian Black Tea Industry	AGT-5A	1/06/98	14/07/98	4 450	—	—	4 450
Market Analyses of Culinary Herbs in Australia and Overseas	AMR-5A	9/06/99	30/11/99	35 000	—	10 000	45 000
Condiment Paprika Breeding, Harvesting and Commercialisation	ASA-1A	1/07/97	30/06/00	174 879	349 836	340 298	865 013

Trialling of the Lift-up Australian Manufactured Tractor Drawn Harvester	ASG-1A	1/04/99	18/01/99	7 000	—	6 500	13 500
Overcoming Production Limitations in Coriander	CAG-1A	22/07/99	1/06/02	75 000	17 100	10 260	102 360
Nutritional Requirements of Coffee Trees in Northern New South Wales	CPE-1A	1/07/97	30/05/02	173 820	—	53 500	227 320
Demonstration and Evaluation of Mechanical Harvesting in New South Wales	DAN-100A	—	30/06/94	11 986	1 000	23 786	36 772
Development of the Herb and Essential Oil Industries	DAN-116A	—	30/06/95	7 000	9 600	3 000	19 600
Determining Whether Pesticide Application Rates for Culinary Herbs Meet MRL Requirements	DAN-179A	30/05/99	30/12/99	3 143	1 048	8 518	12 708
Assembly and Preliminary Evaluation of Imported Tea Clones	DAQ-122A	—	30/07/99	14 470	2 250	46 040	62 760
Management of Strategies for the Cultivation and Mechanical Harvesting of Coffee	DAQ-159A	—	30/06/95	104 759	—	143 970	248 729
Commercialisation of the Walkamin Coffee Processing System	DAQ-160A	—	30/06/94	29 990	—	67 770	97 760
Technology Package for Australian Coffee	DAQ-161A	—	—	23 100	—	—	23 100
Callide Valley Herb and Spice Trial	DAQ-170A	—	30/04/95	5 000	20 670	43 894	69 564
Callide Valley Herb and Spice Trial	DAQ-194A	—	31/10/98	264 930	170 000	464 800	899 730
Northern Australian Cocoa Development	DAQ-256A	2/06/99	30/05/02	450 000	413 000	427 100	1 290 100
Australian Coffee Industry Research and Development Program	DAQ-95A	—	30/06/94	—	—	—	—
Disease Control in Coriander and Other Spice Seeds	DAS-40A	—	2/12/97	157094	20 405	77 848	255 347
Preliminary Investigation into the Commercialisation and Development of Japanese Green Tea, Camelia Sinsense	DAT-20A	—	1/10/94	98548	17 000	36 434	151 982
To Continue the Investigation into the Commercialisation and Development of Japanese Green Tea, Camelia Sinensis	DAT-24A	—	30/06/97	129794	179 998	71 656	381 448
Initial investigation into the commercialisation of Saffron, Crocus sativus	DAT-27A	—	30/06/95	5000	4 000	26 734	35 734
National Tea Research and Development Priority Setting Workshop	DAT-29A	—	31/12/94	8000	3 000	20 160	31 160
Continued Investigation into the Commercial Production and Development of Japanese Green Tea	DAT-31A	—	30/09/98	237452	51 700	162 003	451 155
Alternative Products for Australian Green Tea	DAT-38A	22/07/99	30/10/99	4 931	0	1 891	6 822
Value Added Culinary Herbs	DAV-103A	—	30/03/99	85 607	24 000	222 264	331 871
Edible Flowers- Market Situation and Prospects	DAV-65A	—	—	14 638	—	5 785	20 423
Postharvest Handling and Packaging of Culinary Herbs. A Review	DAV-89A	1/07/94	30/06/95	5 000	5 000	12 500	22 500
North Australian Cocoa Industry Feasibility Study	DNT-25A	30/07/98	30/06/99	10 000	5 000	7 500	22 500
Developing Irrigation Strategies for Coffee Under Sub Tropical Conditions	DPH-1A	1/07/98	30/06/03	95 490	21 000	72 172	188 662
A Workshop to Develop a Strategic Plan for the Australian Herb Industry	FHC-1A	30/06/93	30/11/93	19 500	6 700	1 000	27 200
Prospects for Herb and Spice Production in Australia	HEM-1A	—	30/06/91	10 000	—	—	10 000

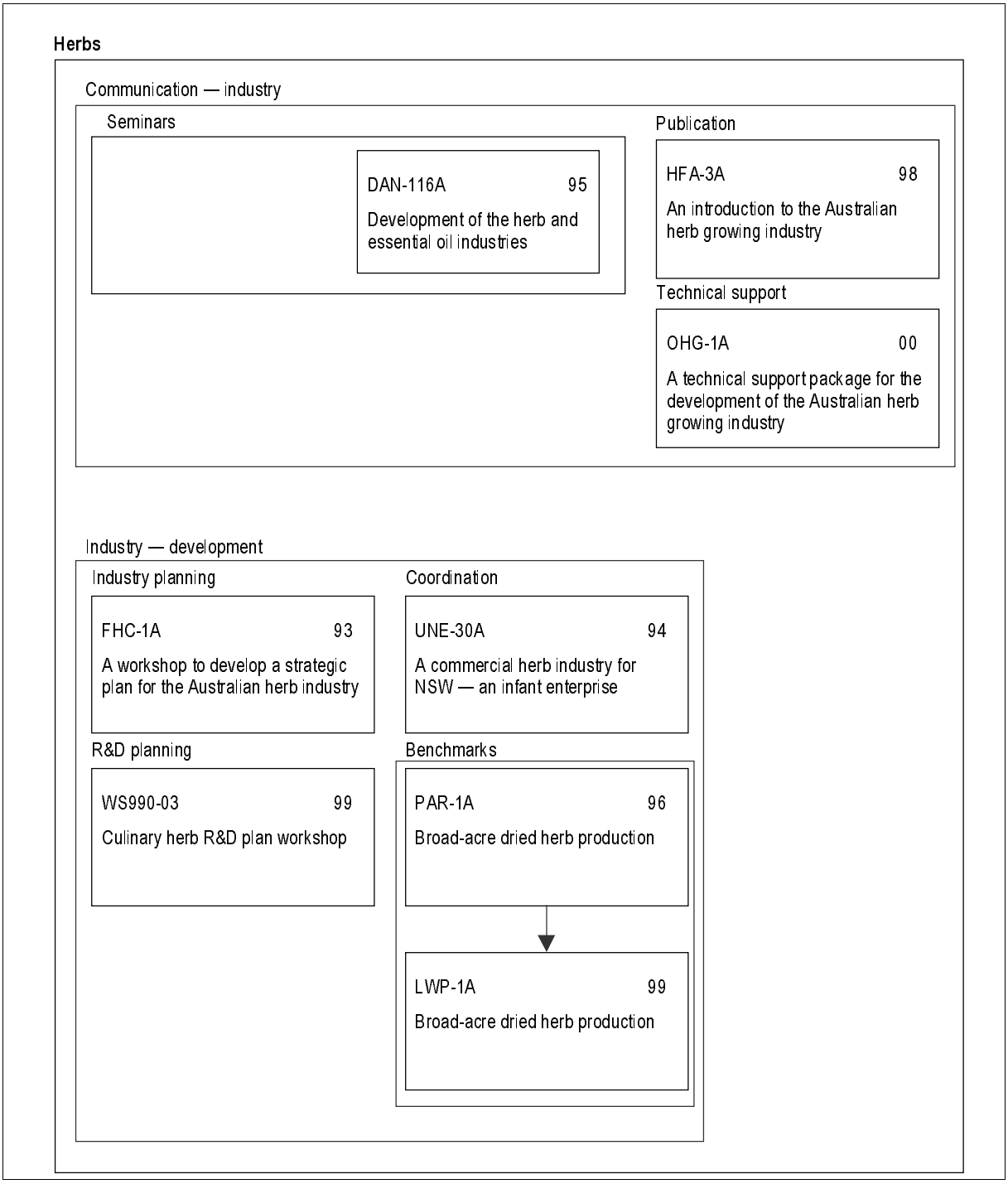
An Introduction to the Australian Herb Growing Industry	HFA-3A	1/11/97	30/03/98	15 000	—	—	15 000
Broad Acre Dried Herb Production	LWP-1A	30/11/95	30/10/99	103 910	83 000	—	186 910
Research Trial on High Density Planting of Black Pepper (Piper Nigrum) for Developing a High Yielding Production System on Melvill	MFP-1A	1/06/91	3/05/94	119 658	70 663	—	190 321
Tractor-drawn Coffee Harvester	MS967-38	1/02/97	30/06/00	13 394	—	—	13 394
Investigations into Production and Commercial Viability of Australia Tea Seed Oil and Improvement of Quality of Australia Green Tea	MTE-1A	1/07/92	30/06/95	141 375	28 500	83 375	253 250
A Technical Support Package for the Development of the Australian Herb Growing Industry	OHG-1A	1/07/98	30/06/00	70 000	20 000	30 800	120 800
Broad-acre Dried Herb Production	PAR-1A	1/01/94	31/12/96	128 000	207 000	0	335 000
Business Plan for the New South Wales Coffee Growing Industry	PMP-3A	8/06/99	8/10/99	10 250	10 500	—	20 750
Spice Production for Import Replacement and Export	SED-1A	1/07/91	30/06/93	72 591	31 545	60 000	164 136
Variety Selection for Cumin Seed Production	SED-7A	1/07/93	30/06/95	39 685	10 000	56 840	106 525
A Commercial Herb Industry for Northern New South Wales - An Infant Enterprise	UNE-30A	1/07/92	30/06/94	141 561	22 000	307 653	471 214
The Evaluation of Volatile Quality Factors in Black Tea	UQ-61A	1/07/96	30/06/92	5 000	5 000	13 250	23 250
Variation in Volatile Aroma Compounds in Australian Grown Black Tea	UQ-66A	1/10/97	30/11/98	2 500	5 000	13 250	20 750
Developing an Index of Quality for Australian Tea	UQ-88A	22/07/99	1/06/02	82 723	13 000	64 392	160 115
Cool Climate Tea Production	VHT-1A	1/07/95	30/06/98	47 500	—	—	47 500
Cullinary Herb R&D Plan Workshop	WS990-03	30/08/99	30/09/99	10 000	—	—	10 000

Source: RIRDC database and files.

Classification

The projects are distributed across the various categories. The early projects tended to be more focused on industry development. This was followed by an emphasis on markets, and the most recent projects are on production and processing issues. The classification is illustrated in chart 3.8, which shows the links between projects, and summarised in table 3.9.

3.8 Projects — classification and initial assessment Culinary herbs and spices and beverages



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3.8 Projects — classification and initial assessment Culinary herbs and spices and beverages
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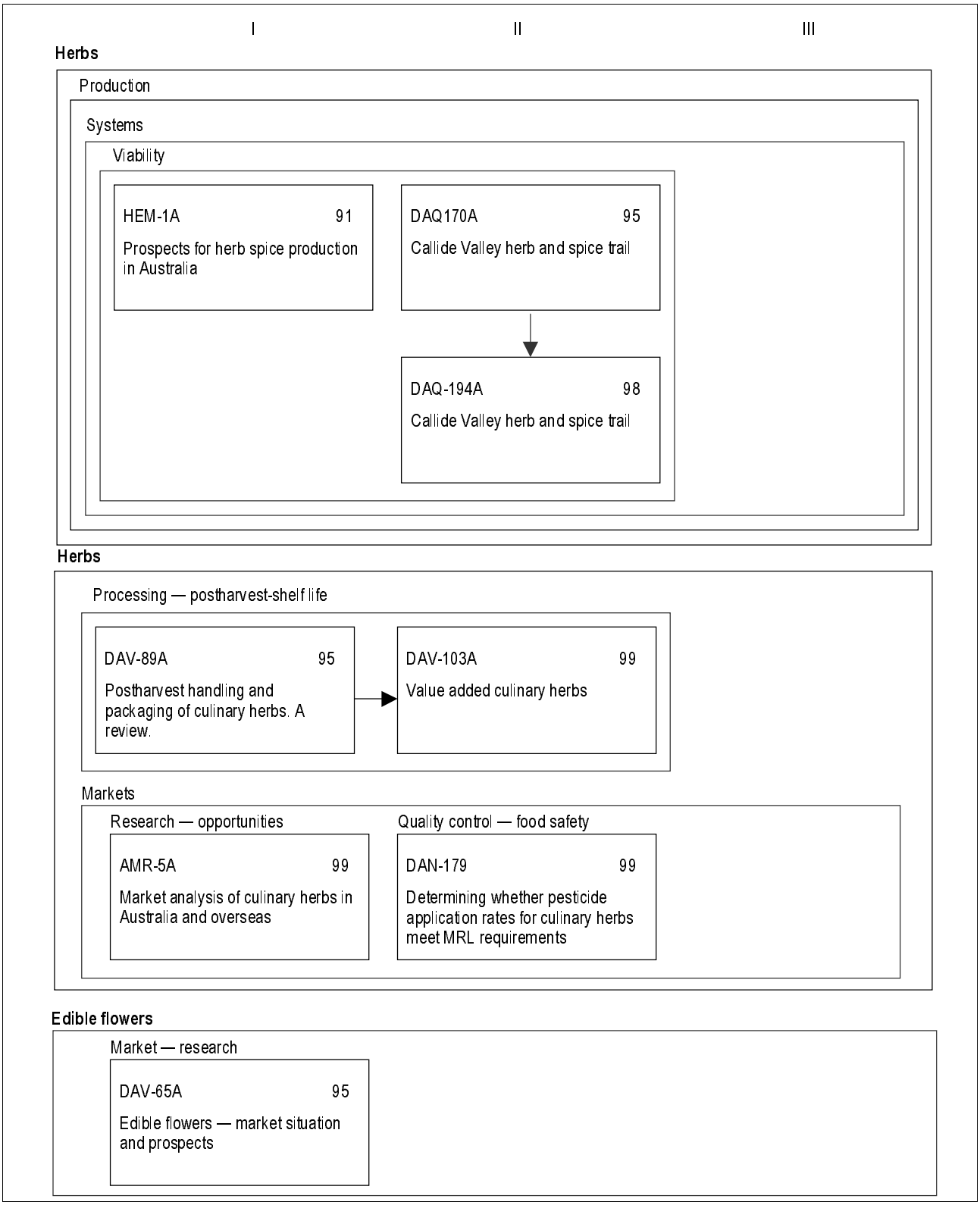

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3.8 Projects — classification and initial assessment Culinary herbs and spices and beverages (Continued)

I II III

Black pepper

Production — systems

MFP-1A 94

Research trial on high density planting of black pepper (*Piper Nigrum*) for developing a high yielding production system on Melvill

Coriander

Production — disease

Treatments

DAS-40A 97

Disease control in coriander and other spice species

Management

CAG-1A 02

Overcoming production limitations in coriander

Cumin

Industry — breeding

SED7A 95

Variety selection for cumin seed production

Saffron

Industry — development

DAT-27A 95

Initial investigation into the commercialisation of Saffron, Crocas sativus

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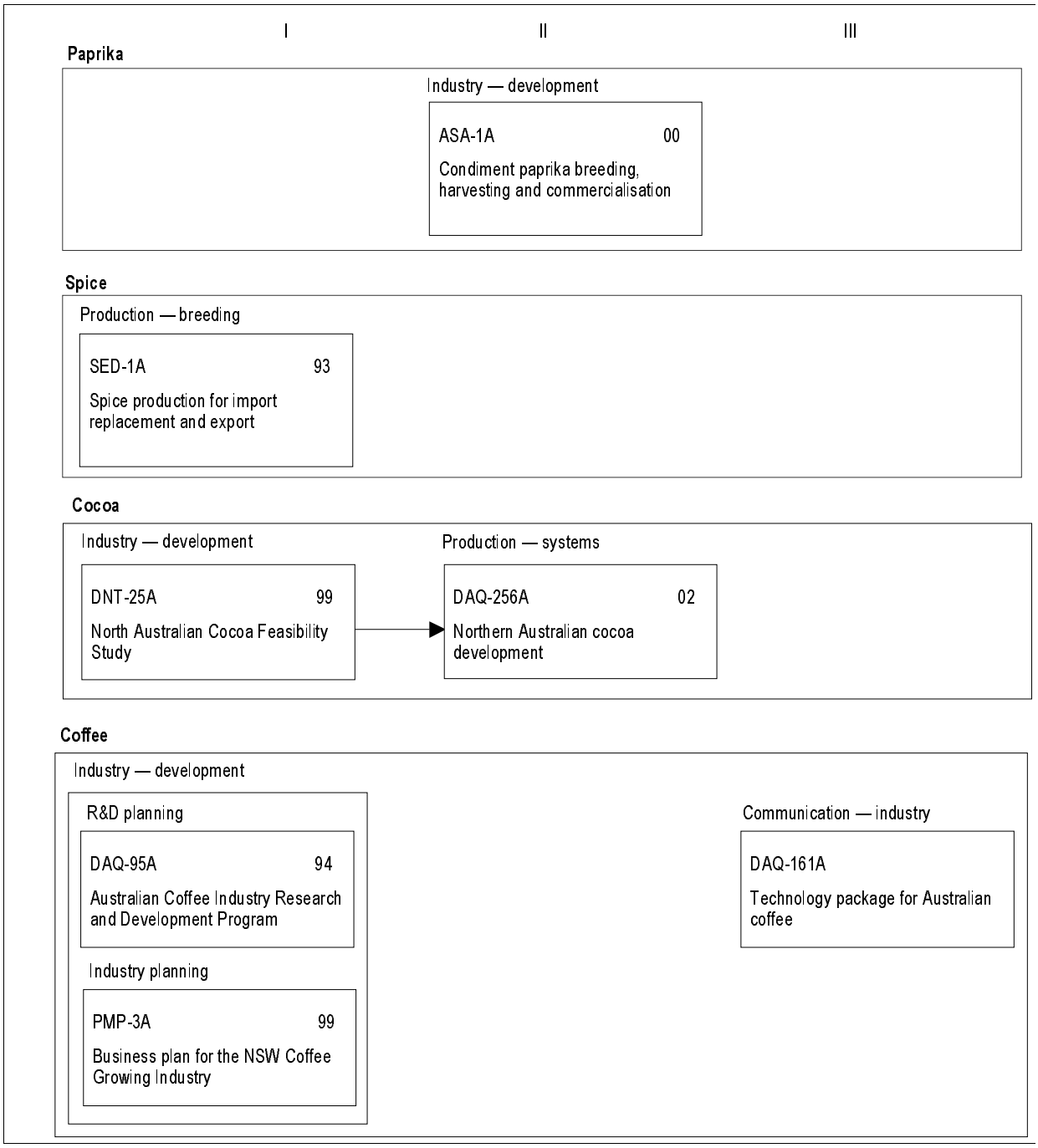
3.8 Projects — classification and initial assessment Culinary herbs and spices and beverages (Continued)



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3.8 Projects — classification and initial assessment Culinary herbs and spices and beverages (Continued)

Coffee (continued)

I II III

Production

Harvest

Management

DAQ-159A 95

Management of strategies for the cultivation and mechanical harvesting of coffee

Machinery

MS967-38 00

Tractor-drawn coffee harvester

DAQ-160A 94

Commercialisation of the walkamin coffee processing system

DAN-100A 94

Demonstration and evaluation of mechanical harvesting in NSW

ASG-1A 99

Trailing of the lift up Australian manufactured tractor drawn harvestor

Nutrition

Irrigation

DPH-1A 03

Developing irrigation strategies for coffee under sub-tropical conditions

Fertilizer

CPE-1A 02

Nutritional requirements of coffee trees in northern NSW

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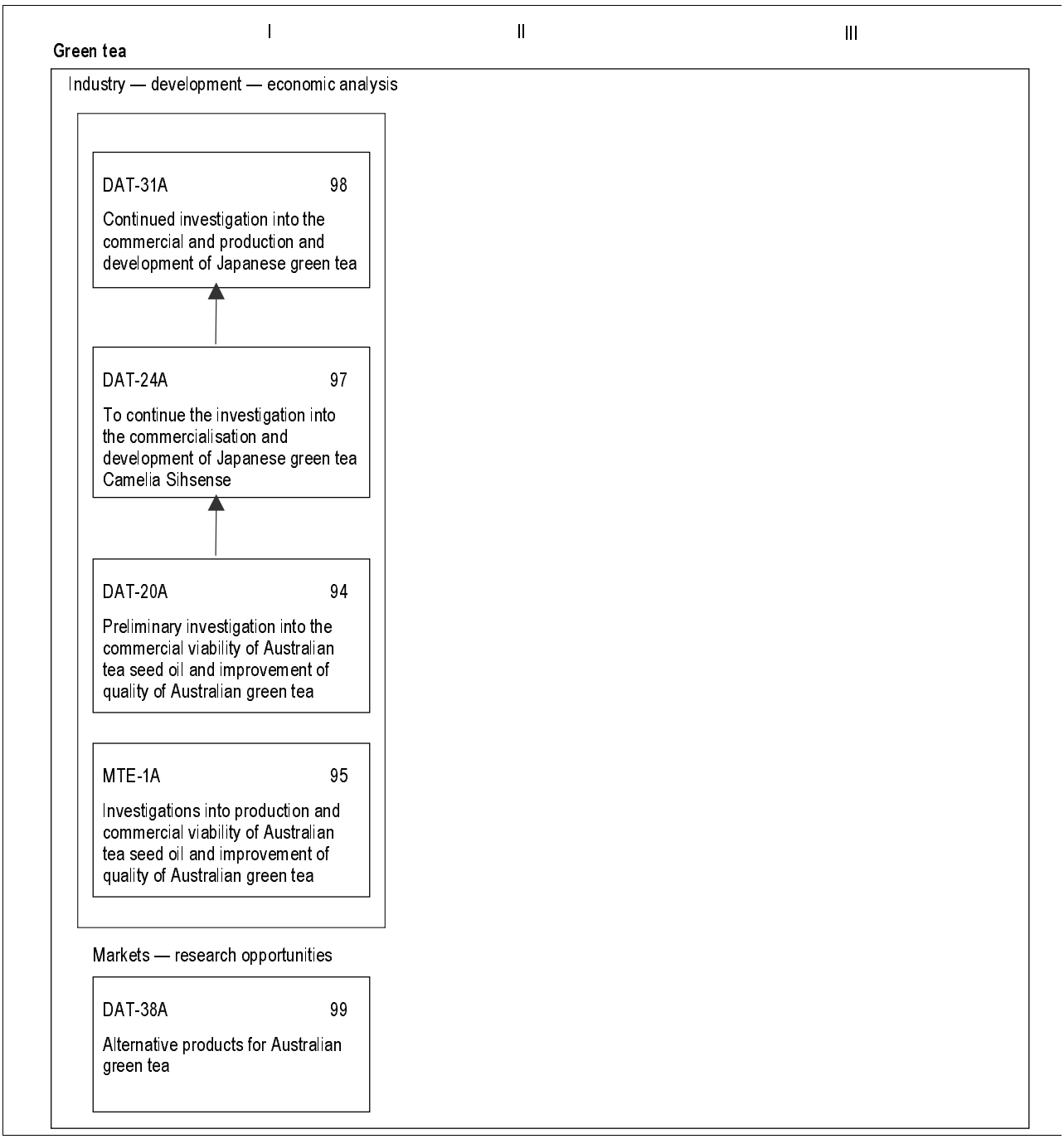
3.8 Projects — classification and initial assessment Culinary herbs and spices and beverages
(Continued)



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3.8 Projects — classification and initial assessment Culinary herbs and spices and beverages (Continued)

I II III

Black tea

Industry — development

R&D planning

DA7-29A 94

National tea research and development priority setting workshop

Economic analysis

AGT-5A 98

Review of the prospects for Australian black tea industry

Black tea

Production

Breeding — evaluation

DAQ122A 99

Assembly and preliminary evaluation of imported tea clones

VHT-1A 98

Cool climate tea production

Systems — physiology

UQ-66A 98

Variation in volatile aroma compounds in Australian grown black tea

Markets

Quality control

Standards

UQ-88A 02

Developing an index of quality for Australian tea

Descriptors

UQ-61A 92

The evaluation of volatile quality factors in black tea

3.9 Projects — classification and initial assessment Culinary herbs and spices and beverages

Project	*Stage*	*Level 1*	*Level 2*	*Level 3*	*Code*	*Evaluation*
Research Trial on High Density Planting of Black Pepper (Piper Nigrum) for Developing a High Yielding Production System on Melvill	2	Production	Production systems	Viability	MFP-1A	Low
Northern Australian Cocoa Development	2	Industry training and development	Production systems	Viability	DAQ-256A	Too early
North Australian Cocoa Industry Feasibility Study	1	Industry training and development	Production systems	Viability	DNT-25A	High
Trialling of the Lift-up Australian Manufactured Tractor Drawn Harvester	2	Production	Harvest	Machines	ASG-1A	Too early
Nutritional Requirements of Coffee Trees in Northern New South Wales	2	Production	Nutrition	Fertilizer	CPE-1A	Too early
Demonstration and Evaluation of Mechanical Harvesting in New South Wales	2	Production	Harvest	Machines	DAN-100A	High
Management of Strategies for the Cultivation and Mechanical Harvesting of Coffee	2	Production	Harvest	Management	DAQ-159A	High
Commercialisation of the Walkamin Coffee Processing System	2	Production	Harvest	Machinery	DAQ-160A	High
Technology Package for Australian Coffee	3	Communication/ technology transfer	Industry	Publication	DAQ-161A	High
Australian Coffee Industry Research and Development Program	1	Industry training and development	Development	R&D Planning	DAQ-95A	High
Developing Irrigation Strategies for Coffee Under Sub Tropical Conditions	2	Production	Nutrition	Irrigation	DPH-1A	Too early
Tractor-drawn Coffee Harvester	2	Production	Harvest	Machinery	MS967-38	High
Business Plan for the New South Wales Coffee Growing Industry	1	Industry training and development	Development	Industry planning	PMP-3A	High
Overcoming Production Limitations in Coriander	2	Production	Disease	Management	CAG-1A	High
Disease Control in Coriander and Other Spice Seeds	2	Production	Disease	Treatments	DAS-40A	High
Variety Selection for Cumin Seed Production	1	Industry training and development	Breeding	Selection	SED-7A	Not known
Edible Flowers- Market Situation and Prospects	1	Markets	Market Research	Opportunities	DAV-65A	Low/Medium
Preliminary Investigation into the Commercialisation and Development of Japanese Green Tea, Camelia Sinsense	1	Industry training and development	Development	Economic analysis	DAT-20A	Medium
To Continue the Investigation into the Commercialisation and Development of Japanese Green Tea, Camelia Sinensis	1	Industry training and development	Development	Economic analysis	DAT-24A	Medium
Continued Investigation into the Commercial Production and Development of Japanese Green Tea	1	Industry training and development	Development	Economic analysis	DAT-31A	Medium
Alternative Products for Australian Green Tea	1	Markets	Market Research	Opportunities	DAT-38A	Too early
Investigations into Production and Commercial Viability of Australia Tea Seed Oil and Improvement of Quality of Australia Green Tea	1	Industry training and development	Development	Economic analysis	MTE-1A	Not known
Market Analyses of Culinary Herbs in Australia and Overseas	1	Markets	Market Research	Opportunities	AMR-5A	Too early
Development of the Herb and Essential Oil Industries	2	Industry training and development	Development	Industry planning/ associations	DAN-116A	High
Determining Whether Pesticide Application Rates for Culinary Herbs meet MRL Requirements	2	Markets	Quality control	Food safety	DAN-179A	High
Callide Valley Herb and Spice Trial	2	Production	Systems	Viability	DAQ-170A	High
Callide Valley Herb and Spice Trial	2	Production	Systems	Viability	DAQ-194A	High
Value Added Culinary Herbs	2	Processing	Post harvest	Shelf-life	DAV-103A	High

Postharvest Handling and Packaging of Culinary Herbs. A Review	1	Processing	Post harvest	Shelf-life	DAV-89A	High
A Workshop to Develop a Strategic Plan for the Australian Herb Industry	1	Industry training and development	Development	Industry planning	FHC-1A	Low
Prospects for Herb and Spice Production in Australia	1	Production	Systems	Viability	HEM-1A	Medium/high
An Introduction to the Australian Herb Growing Industry	3	Communication/technology transfer	Industry	Publication	HFA-3A	Medium/high
Broad Acre Dried Herb Production	2	Production Production Processing Industry	Breeding Harvesting Simple Development	Selection Machinery Machinery Bechmarks	LWP-1A	Low
A Technical Support Package for the Development of the Australian Herb Growing Industry	3	Communication/technology transfer	Industry	Technical support	OHG-1A	Medium/high
Broad-Acre Dried Herb Production	2	Production Production Processing Industry	Breeding Harvesting Simple Development	Selection Machinery Machinery Bechmarks	PAR-1A	Low
A Commercial Herb Industry for Northern New South Wales - An Infant Enterprise	2	Industry training and development	Development	Co-ordination	UNE-30A	Medium/high
Cullinary Herb R&D Plan Workshop	1	Industry training and development	Development	R&D Planning	WS990-03	Medium
Condiment Paprika Breeding, Harvesting and Commercialisation	2	Industry training and development	Development	Economic analysis	ASA-1A	Medium
Initial Investigation into the Commercialisation of Saffron, Crocus Sativus	1	Industry training and development	Development	Economic analysis	DAT-27A	Medium
Spice Production for Import Replacement and Export	1	Production	Breeding	Evaluation	SED-1A	Medium
Review of the Prospects for the Australian Black Tea Industry	1	Industry training and development	Development	Economic analysis	AGT-5A	Medium/high
Assembly and Preliminary Evaluation of Imported Tea Clones	1	Production	Breeding	Evaluation	DAQ-122A	Low
National tea Research and Development Priority Setting Workshop	1	Industry training and development	Development	R&D Planning	DAT-29A	Low
The Evaluation of Volatile Quality Factors in Black Tea	2	Markets	Quality control	Descriptions	UQ-61A	Too early
Variation in Volatile Aroma Compounds in Australian Grown Black Tea	1	Production	Systems	Physiology	UQ-66A	Low
Developing an Index of Quality for Australian Tea	2	Markets	Quality control	Standards	UQ-88A	Too early
Cool Climate Tea Production	2	Not known			VHT-1A	Not known

Source: RIRDC database and files.

Initial assessment

The initial assessment is based on the project manager's judgement of the outcome of the project. A summary of each project group, as set out in chart 3.8 is provided. Most of the projects have focused on a specific product or groups of products. Table 3.9 summarises the assessment.

Herbs – communication

There have been three projects that improved communication to the industry.

- DAN-116A *Development of the Herb and Essential Oil Industries* was a workshop. The herb and essential oils industries are thought not to be maximising their full potential because they lack a peak body, effective organisation and technical support. Recommendations were made at the workshop for development strategies for the industries, especially in the area of provision of information to potential entrants. The Spice Association of Australasia was identified as the peak industry body. There was a strong response from participants and interest in follow up activities.

The publication that resulted from this workshop is very popular and in constant demand. Extension has been excellent, so the impact is thought to be high.

- HFA-3A *An Introduction to the Australian Herb Growing Industry* produced a booklet to introduce the herb growing industry to new investors. It was initiated because RIRDC were receiving a lot of inquiries on the herb industry, and they wanted to ensure that accurate information was reaching the people who needed it. It is a very popular publication, so the project is assessed as having a medium/high impact.
- OHG-1A *A Technical Support Package for the Development of the Australian Herb Growing Industry* aimed to have an electronic database on the internet which will enable people in the organic industry to readily access technical and commercial information. It is still in progress, but will probably have a high/medium impact.

Herbs – industry development

The R&D activities under this classification have been varied. They include industry planning, R&D planning, coordination to support an infant industry, and developing benchmarks.

- FHC-1A *A Workshop to Develop a Strategic Plan for the Australian Herb Industry* was an industry planning workshop. The herb industry in Australia is growing but there was concern about the coordination of the large amount of R&D being invested. The workshop recommended that an active network be established, a steering committee be appointed to assess industry support for such a network, and a herb industry forum be held within six months. However, the industry remained fragmented and the priorities and conclusions established were not used. Because of this, it has had a low impact.
- WS990-03 *Culinary Herb R&D Plan Workshop* was recently undertaken because of the recognised need for an R&D plan in the herb industry, especially because the size of the industry is so big ($25 million). The impacts are hard to judge because the draft R&D plan is still being considered. The impact, however, is expected to be medium because the R&D plan will influence RIRDC's funding and commercial contributions there to.
- UNE-30A *A Commercial Herb Industry for Northern New South Wales — An Infant Enterprise* was a feasibility study has shown that herbs are a potential growth industry, particularly for Northern New South Wales. Previous work has identified herb types suitable for Australia and this project aims to establish an integrated industry of herb production in Northern New South Wales. A small local industry has been established that has used the production guides that were developed in this project. It has probably had a medium high impact.
- PAR-1A *Broad-Acre Dried Herb Production* was taken over by LWP-1A *Broad acre dried herb production*. Australia imports much of its herb consumption and this project aims to establish an industry that will replace these imports. It will do this by selecting and trialling herbs suited to the Mediterranean climate, designing, developing and testing a herb harvester and drying facility. This project project has not been as successful as anticipated because of local government intervention in the building of the drying facilities.

Herbs – production

There have been two sets of projects looking at the physical as well as economic viability of production.

- DAQ-170A and DAQ-194A *Callide Valley Herb and Spice Trial* is a search for an alternative crop in the region. Following a reduction in their water allocation, farmers in the Callide valley need to change to a high yielding low water use crop. Herbs and spices have been identified as a possible alternative, and this project looked at more than 3000 different spices for their suitability. Thirty-nine varieties were shown to be suitable with high or medium market demand. Public support is

strong and an association has been established to promote the course of this potential new industry. The growers have set up at least one company as a result of this, so the impact would be very high. These projects are evaluated in stage 2 of this report.

- HEM-1A *Prospects for Herb and Spice Production in Australia* is a preliminary report on the prospects of growing, processing and marketing culinary herbs in Australia. There have been many requests for the final report, indicating a high level of interest. Therefore the impact would be medium/high.

Herbs – processing

There was a severe lack of knowledge on handling of a huge range of species and varieties.

DAV-89A *Post-harvest Handling and Packaging of Culinary Herbs — A Review* aimed to identify new and emerging technologies and to identify research priorities. It concluded that there was considerable potential to improve the handling of herbs and spices, which led on to DAV-103A *Value-added Culinary Herbs*. This project thus aimed to minimise quality loss and add value by developing optimum post-harvest protocols and new modified atmosphere packaging systems. The project developed methods that increased shelf life by as much as 50 per cent. Industry interest in the project is high with many requests for information and two contract research projects are under negotiation. The impact of these two projects would therefore be high.

Herbs – markets

Two very different projects fall into this category.

- AMR-5A *Market Analyses of Culinary Herbs in Australia and Overseas* is a very good project that as yet has not been formally completed. An interested party from Lismore thought that New South Wales was a good location for production, freezing, and packing herbs, but he was unsure of the market. This report defined the opportunities available very well, and identified the fast-food market as that with the best potential. It is too early to say if this will result in any activity in the area, but it looks promising.
- DAN-179A *Determining Whether Pesticide Application Rates for Culinary Herbs meet MRL Requirements* is aimed to maintain current market access because of the concern that the residues of some pesticides are over MRL guidelines. It was very useful work in that it provided farmers with the information to successfully apply to get permission for the use of some chemicals. It is assessed as having a high impact.

A marketing project has also been undertaken on edible flowers. DAV-65A *Edible Flowers — Market Situation and Prospects* was stimulated by the fact that the market for edible flowers as garnishes in restaurants has been increasing. This survey assessed the current uses of edible flowers, the supply chain and so on. It determined that there is a shortage of information on the edibility of many flowers and inadequate promotion. It concluded that there is limited scope for an expansion of edible flower production. It is doubtful if this project had much impact, so the judgement is that it probably had a low/medium impact. It is doubtful if this sort of project would go ahead today if it were proposed.

Spices

Most of the projects on spices have concentrated on individual spices.

Black Pepper — MFP-1A *Research Trial on High Density Planting of Black Pepper for Developing a High Yielding Production System on Melvill* undertook a trial and evaluation of economics and

marketing. The prospects were not good for the development of this product in the area and as no investment was planned the project is assessed as having a low impact.

Coriander — Coriander has the potential to be worth $5 million a year but at the moment is constrained by diseases, such as an outbreak in 1993. DAS-40A *Disease Control in Coriander and Other Spice Seeds* developed a protocol for testing seed for bacterial blight with sufficient accuracy and a low cost method of eliminating bacteria from seed by acid treatment has been developed. Routine applications of protectant fungicides were found not to be economically justified. Applying disease control strategies from this project will result in improved production and reductions in ineffective current inputs will improve profitability. This project was followed up by CAG-1A.

CAG-1A *Overcoming Production Limitations in Coriander* is undertaking further work on bacterial blight, hoping to develop a commercially available acid seed treatment. It also aimed to distribute best management information packages, and establish disease diagnostic services. A survey is also to be carried out in order to determine the importance of diseases. This project is new, but evaluated together; DAS-40A and CAG-1A are expected to have a high impact. It also has had the spin-off of allowing the farmers to work together.

Cumin — SED-7A *Variety Selection for Cumin Seed Production* aims to further evaluate selected seed from cumin, continue the build-up of selected lines and to consolidate R&D into the agronomic constraints of seed production.

Saffron — DAT-27A *Investigation into the Commercialisation of Saffron* concluded that there was some potential, perhaps more as a cottage-based industry than with large commercial growers. The returns are however limited and the industry is highly labour intensive. RIRDC does get inquiries about this product, so this project has meant that RIRDC has been able to give good advice, and the impact has been judged as medium.

Paprika — ASA-1A *Condiment Paprika Breeding, Harvesting and Commercialisation* is still continuing, but will probably have a medium impact. It was designed to select overseas lines of paprika for breeding in Australia and has identified some lines with good characteristics for use as condiments. To have enabled good information exchanges and networks to be set up between Australia and Hungary and there is expected to be a follow-up project.

Spices — SED-1A *Spice Production for Import Replacement and Export* collected and evaluated a wide range of germplasms and conducted agronomic trials and developed agronomic management programs. The motivation was market research that confirmed significant potential in Australia for a wide range of spices. This project provides a basic technical package for the development of a successful spice industry, although more detailed R&D will be needed for individual spices in the future. It has lead to the identification and release of one line of coriander and has probably had a medium impact.

Cocoa

Two projects have been conducted on cocoa, both assessing feasibility — the first of the industry generally, the second of production.

- DNT-25A *North Australian Cocoa Industry Feasibility Study* was a small project from RIRDC's point of view, but there was a large industry commitment. Cadbury-Schwepps approached RIRDC to do a scoping and feasibility study on the cocoa industry because alternative supplies, such as from Africa, have reliability problems. It looked at the Malay industry, and determined that an industry in Australia does have potential, but would need to operate at best practice. The impact

would be high because it gave RIRDC greater confidence to fund further projects, such as the follow-up project to this, DAQ-256A.

- DAQ-256A *Northern Australian Cocoa Development* is a large project that is in progress where yield potential is to be assessed and agronomic aspects will be recorded. Technology and mechanical aspects and decision support will be also be developed.

Coffee

Coffee R&D has received considerable attention and allocation of funds under the program. Two areas have received particular attention — industry development and production — particularly harvesting which is a high cost area where Australia cannot compete against low labour cost countries.

DAQ-95A *Australian Coffee Industry Research and Development Program* was a review of the end of the five year program in 1992-93. The review concluded that the R&D program assume only a modest size, but the industry is expected to grow. Gaps of knowledge and challenges for the industry were identified and the priorities that were developed resulted in the following projects.

- PMP-3A *Business Plan for the New South Wales Coffee Growing Industry.*
- DAQ-161A *Technology Package for Australian Coffee.*
- DAQ-160A *Commercialisation of the Walkamin Coffee Processing System.*
- DAQ-159A *Management Strategies for the Cultivation and Mechanical Harvesting of Coffee.*
- MS967-38 *Tractor-drawn Coffee Harvester Production.*
- DAN-100A *Demonstration and Evaluation of Mechanical Harvesting in New South Wales*

Work has been done on mechanisation, nutrition and other practices. Major progress has been made, especially in the area of mechanisation, with the development of a harvester that has greater selectivity of the coffee cherry and less damage to the trees. The harvester is widely used in Australia and overseas. The other outputs of the projects complemented the harvester development, synchronising flowering. It is unlikely that in the absence of these projects the industry would have developed. Currently Australian coffee commands a premium price with niche market status. Substantial expansion of production will eventually erode some of this premium. The projects are expected to have a high return. They form part of the set for evaluation in the second stage of this report.

The three current projects that did not result from the 1993 R&D review. Two, DPH-1A *Developing Irrigation Strategies for Coffee Under Sub-Tropical Conditions* and CPE-1A *Nutritional Requirements of Coffee Trees in Northern New South Wales* were designed specifically for New South Wales rather than for Queensland, as future growth in the industry is expected to be in New South Wales. The last project, MS967-38 *Trialling of the Lift-up Australian Manufactured Tractor Drawn Harvester,* was initiated because the regular coffee harvester is inappropriate for small farmers, it trials a tractor drawn harvester.

Green Tea

Five projects on green tea have been undertaken. Three are directly related.

MTE-1A *Investigations into Production and Commercial Viability of Australian Tea Seed Oil and Improvement of Quality of Australian Green Tea* This was designed to develop tea products in Australia for national and international use.

DAT-20A *Preliminary Investigation into the Commercialisation and Development of Japanese Green Tea*, DAT-24A *Continue the Investigation into the Commercialisation and Development of Japanese Green Tea* and DAT-31A *Continued Investigation into the Commercial Production and Development of Japanese Green Tea* all focused on the development of a green tea industry in Tasmania. Due to pollution and urbanisation, production of Japanese green tea in Japan has been falling and Tasmania has been identified as a possible alternative site for production. These three projects above evaluated the feasibility of this proposal. Clones were brought into Australia, and a trialling process began, with Japanese evaluation of the final product. Investigations into processing and gross margin analysis were also conducted. The results determined which cultivars and sites are best in Tasmania for green tea production. However, the commercial partner backed out of this project and the department is not following up the findings at this point in time. Nevertheless, the nature of this industry is that Japanese companies are regularly inquiring about production in Tasmania and undertaking their own developmental work. This means that these companies may have used some of these findings, so it is suspected that the projects have had a medium impact.

DAT-38A *Alternative Products for Australian Green Tea* is designed to evaluate the potential of value added products from green tea such as extracts and health products. This has been initiated because the margins in tea productions are not high, but these value-added products may be quite lucrative. The project is still in progress, so it is too early to judge the outcome.

Black tea

Several projects have focused on industry development issues.

- DAT-29A *National Tea Research and Development Priority Setting Workshop* was a workshop. It developed a vision for the future direction of the Australian tea industry over the next ten years and to determine priority areas for further R&D work through the formulation of a strategic plan. This was designed to try and reform the industry, which is commonly seen as disorganised. However, possibly because of this disorganisation, the workshop has not had much impact. The assessment is that the impact would probably be low, even though it was a good workshop that came up with priorities for the industry.
- AGT-5A *Review of the Prospects for the Australian Black Tea Industry* is a review of the industry. It was initiated because of the number of approaches RIRDC was getting from the industry on the profitability of investments and developments in the industry. It showed that the industry is quite marginal but could be improved by improvements in nutrition, clonal plantings and so on. It is viewed as a clear statement on the status of the industry and has influenced RIRDC decision making in relation to the program. Therefore it is judged to have had a medium/high impact.

Two projects have looked at production issues.

- DAQ-122A *Assembly and Preliminary Evaluation of Imported Tea Clones* tested a range of clones with potential for their adaptation to the local environment. Most of Australia's tea production is based on seedling material introduced to the country in the 1930's. Experience in other countries has shown that selected high yielding clones can increase yield by 100 per cent and improve quality. Clones have been evaluated to remove the variability in quality that is present in seeds, providing certainty as to what will grow. As yet however, these clones have not been evaluated, if they have, the information has not been made available to RIRDC, so the impact has been low.
- UQ-66A *Variation in Volatile Aroma Compounds in Australian Grown Black Tea* was terminated, so there has been no output.
- VHT-1A *Cool Climate Tea Production*. Little is known about this project.

Two projects have looked at markets.

- UQ-61A *The Evaluation of Volatile Quality Factors in Black Tea* was the forerunner to UQ-88A. It characterised the organic substances in tea, which improve its quality. Industry is continuing in-kind support for this project, but any evaluation should include an evaluation of UQ-88A, and because this is too early to evaluate, we cannot judge the impact of UQ-61A.
- UQ-88A *Developing an Index of Quality for Australian Tea* is still in progress and so it is too early to judge what the effect might be. It is intended to develop objective quality management of tea through chemical analysis of the product. If all goes as intended, it will give the industry a tool to judge the quality of tea.

Extractive and fibre crops

Projects

Extractive and fibre crops cover a wide range of products, the unifying theme being the requirement for processing as it is the processed rather than fresh product that is the main market. The main products covered are new extracts, bioassays, and so on for medicinal or other uses, oils such as olive and new oilseeds for edible and industrial oil and new plant fibres for paper and other uses. Most of the industries are in the stage of assessing feasibility and developing commercial production. Garlic has grown to a farm gate value of around $3.5 million. (Evans, January 2000)

There have been 41 projects undertaken under this area of the program. Beverages make up 22 of these projects. The total cost of these projects is $9.5 million of which 26 per cent has been funded by RIRDC. The projects are listed in table 3.10.

3.10 **Projects — timing and funding Extractive and fibre crops**

Project	*Code*	*Start date*	*Finish date*	*RIRDC total*	*Industry total*	*Research organisation total*	*Total*
Characterisation of Antiviral Compounds in Australian Bush Medicines	USA-5A	1/07/97	30/08/98	16 000	0	13 000	29 000
Research and Development and Production of Virus-tested Garlic, Garlic Seeds and Garlic By-products	BIO-1A	—	30/06/99	330 000	0	703 000	1 033 000
A Cholesterol-lowering Extract from Garlic: Opportunities for an Australian Industry	DAV-124A	—	30/10/99	238 734	2 239 541	320 182	2 798 457
Increasing the Export Potential Opportunities for Australian Garlic	DAV-163A	—	—	45 000	0	0	45 000
Investigation into the Commercialisation and Development of Ginseng	DAT-22A	—	30/06/95	119 386	18 500	102 023	239 909
Initial Investigation into the Commercialisation of Siberian Ginseng Eleutherococcus Senticosus	DAT-28A	—	30/06/95	10 000	4 000	26 634	40 634
Australian Ginseng Research Program: Crop Establishment	POP-1A	—	—	20 000	105 030	9 000	134 030
Pre-Feasibility Studies for Manufacturing Selected Industrial Hemp Products in Australia	PMP-1A	15/06/96	—	30 000	—	30 000	60 000
Second Hemp Workshop	WS967-24	19/08/97	19/08/97	10 000	—	—	10 000
Hemp Industry Consultancy - Yorke Regional Development Board	YRD-1A	29/09/95	15/12/95	10 000	—	—	10 000
Commercial Production of Medicinal Herbs in Tasmania	DAT-26A	—	14/02/98	64 842	7 100	55 282	127 224
Feasibility and Profitability of Jojoba	DAN-117A	—	—	3 500	—	—	3 500

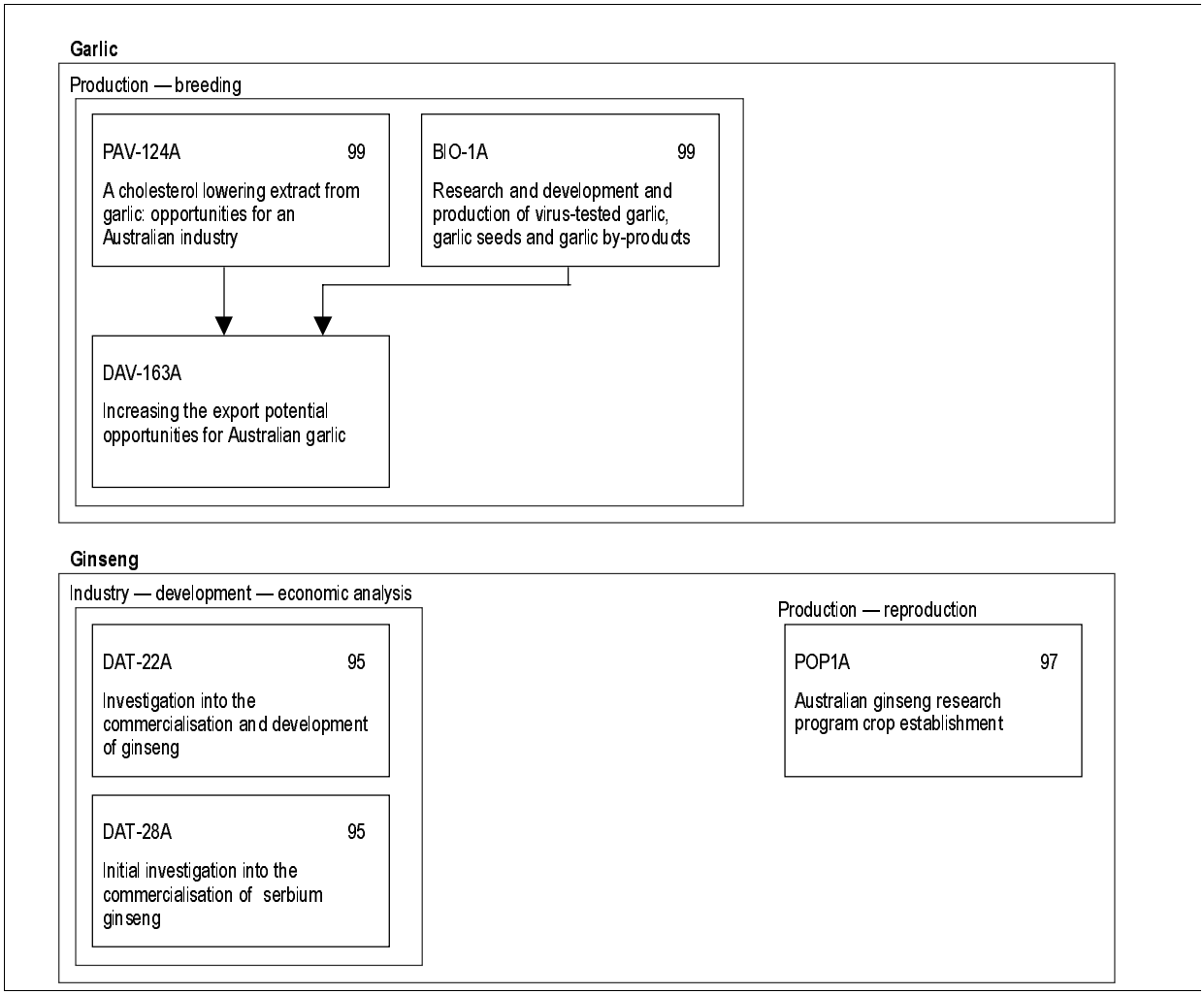
Establishment of Preliminary Nutrient Standards for Jojoba Using Leaf Tissue Analysis	DAN-149A	—	31/03/97	6 900	9 750	21 260	37 910
A Screening Technique for the Rapid Selection of Suitable Jojoba Cultivars	DAN-65A	—	30/06/94	55 954	1 700	185 392	243 046
Discovering the Market Potential for Australian Jojoba Products	HAS-4A	1/01/91	30/06/99	18 000	0	3 000	21 000
Jojoba R&D Planning Workshop	WS967-20	28/05/97	28/05/97	6 658	—	—	6 658
Preliminary Studies Towards the Commercialisation of the Neem Tree in Australia	DAQ-146A	—	30/06/94	88 900	208 000	196 500	493 400
New High Quality Oil Seed Crops for Temperate and Tropical Australia	UWA-47A	1/07/98	30/06/02	156 000	32 000	203 000	391 000
Australian Olive Association Conferlinking	AOL-1A	1/12/97	1/12/99	4 000	0	0	4 000
Olive Pruning Video	AOL-2A	15/12/97	—	10 000	—	—	10 000
OLIVEAUS - Australian Olive Association Magazine	AOL-3A	4/08/98	10/09/01	24 000	15 000	111 000	150 000
Australian Olive Industry R&D Workshop	AOL-4A	7/01/99	7/04/99	10 000	—	—	10 000
Pruning Olive Trees After Year 2	AOL-5A	21/06/99	30/05/99	10 000	—	—	10 000
Gel-Pro Analyser Software	BOG-1A	13/05/99	1/04/00	3 500	—	—	3 500
To Undertake a Pre-feasibility Study to Assess the Market Potential and Establish the Commercial Viability for the Development of an Olive Industry in Australia	DAQ-210A	1/07/98	30/06/95	75 345	10 000	77 992	163 337
An Investigation into the Commercial Potential of an Olive Industry in Australia - A Pilot Study	DAS-37A	—	30/04/95	27 800	0	43 880	71 680
Olive Variety Assessment for Subtropical Summer Rainfall Regions	OAP-1A	16/07/99	30/11/02	27 050	36 050	0	63 100
Realising the Potential of the Olive	SAL-1A	8/04/99	23/08/99	5 000	—	—	5 000
National Olive Variety Assessment Project (NOVA)	SAR-23A	15/07/99	30/11/02	226 304	136 313	842 197	1 204 814
Wild Olive Selection for Quality Oil Production	UA-41A	1/07/97	30/06/00	127 088	121 181	523 234	771 503
Monitoring the Relationship Between Olive Water Use and Yield	UA-47A	1/07/98	31/03/01	97 980	0	91 687	189 667
Assessment of Olive Yield and Oil Quality and Cultivar Identification	UCS-19A	1/07/97	30/11/00	100 027	0	108 237	208 264
Olive R&D Planning Workshop	WS978-01	2/09/97	2/09/97	11 239	—	—	11 239
Establishment of a Flax Fibre Industry in Australia	AMA-1A	—	30/06/92	14 000	—	—	14 000
Economic Market Analysis of Fibre Crops in Australia	PMP-2A	1/08/98	2/08/99	45 000	0	0	45 000
Food Colours from the Family Rubiaceae	UNS-7A	30/06/93	30/06/96	74 950	135 000	21 000	230 950
Feasiblity Study of Salicornieae as Oil-seed Halophytes for Saline Land and Water	DAV-88A	1/07/94	30/06/96	51 260	5 000	30 590	86 850
The Utilisation of Seaweed as a Source of Omega-3 Fatty Acids and Beta-carotene	DAV-87A	1/07/94	30/12/94	88 000	100 000	83 035	271 035
Potential for Seed Gum Production Within Australia	UCQ-12A	1/07/98	30/11/00	56 000	7 000	15 400	78 400
The Selection of Sugarbeet Varieties Suitable for Commercial Cropping and Milling on Marginal Soils in the Burdekin and Mackay	CSR-1A	—	30/06/95	127 026	0	4 644	131 670
Evaluation of the Commercial Potential of Sugarbeet on the Atherton Tableland	DAQ-211A	1/07/98	30/06/00	22 970	16 570	28 964	68 504

Source: RIRDC database and files.

Classification

The projects are distributed across the various categories. The early projects tended to be more focused on industry development. This was followed by an emphasis on markets, and the most recent projects are on production and processing issues. The classification is illustrated in chart 3.10, which shows the links between projects, and summarised in table 3.11.

3.11 **Projects — classification and initial assessment Extractive and fibre crops**



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3.11 **Projects — classification and initial assessment Extractive and fibre crops** (Continued)

	I	II	III
Rubiaceae			
		Processing — complex	
		UNS-7A 96 Food colours from the family rubiaceae	
Seaweed			
	Processing — complex		
	DAV-87A 94 The utilisation of seaweed as a source of omega-3 fatty acids and beta-carotene		
Seed gum			
	Industry — development		
	UCQ-12A 00 Potential for seed gum production within Australia		
Sugarbeet			
	Industry — development		
	DAQ-211A 00 Evaluation of the commercial potential of sugarbeet on the Atherton Tableland		
	Production — breeding		
	CSR-IA 95 The selection of sugarbeet varieties suitable for commercial cropping and milling on marginal soils in Burdekin and Mackay		

(Continued on next page)

3.11 **Projects — classification and initial assessment Extractive and fibre crops** (Continued)

	I	II	III
Medicinal herbs			
		Production — systems DAT-26A 98 Commercial production of medicinal herbs in Tasmania	
Bush medicines			
	Processing — complex USA-5A 98 Characterisation of antiviral compounds in Australian bush medicines		
Neem tree			
		Industry — development DAQ-146A 94 Prelimary studies towards the commercialisation of the Neem tree in Australia	

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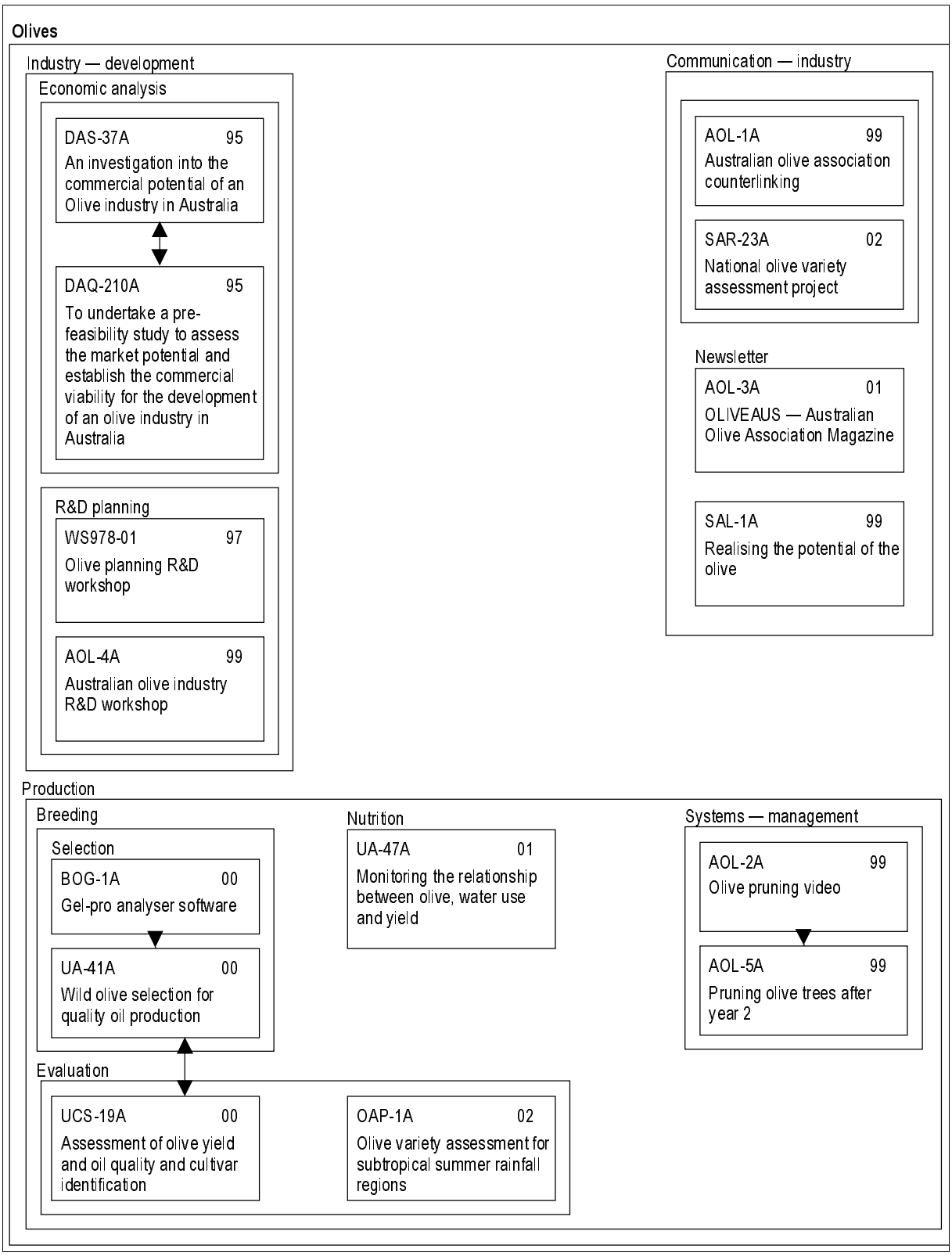

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3.11 **Projects — classification and initial assessment Extractive and fibre crops** (Continued)

Oil seeds

Production

Breeding — evaluation

QWA-47A 96

New high quality oil seed crops for temperate and tropical Australia

Environmental sustainability — salinity resistant

DAV-88A 96

Salicornieae for saline land and water

Hemp

Communications — industry — seminars

WS967 97

Second hemp workshop

Industry — development

YRD-1A 95

Hemp Industry Consultancy – York Regional Development Board

Markets — research

PMP-1A 96-97

Pre-feasibility studies for manufacturing selected industrial hemp products in Australia

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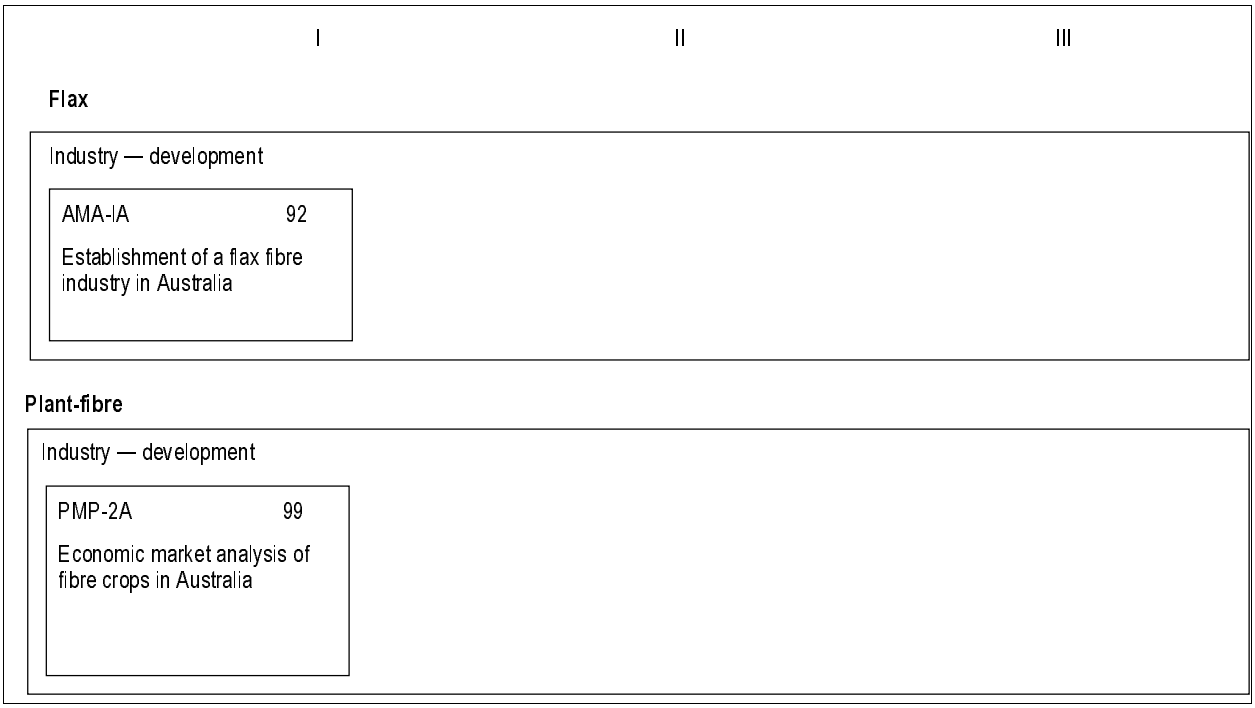
3.11 **Projects — classification and initial assessment Extractive and fibre crops** (Continued)



Initial assessment

The initial assessment is based on the project manager's judgement of the outcome of the project. A summary of each project group, as set out in chart 3.11 is provided. Most of the projects have focused on a specific product or groups of products. Table 3.12 summarises the assessment.

3.12 **Projects — classification and initial assessment Extractive and fibre crops**

Project	*Stage*	*Level 1*	*Level 2*	*Level 3*	*Code*	*Evaluation*
Establishment of a Flax Fibre Industry in Australia	1	Industry training and development	Development	Economic analysis	AMA-1A	Medium
Australian Olive Association Conferlinking	3	Communication/ technology transfer	Industry	Networking	AOL-1A	Medium
Olive Pruning Video	3	Production	Systems	Management	AOL-2A	High
OLIVEAUS - Australian Olive Association Magazine	3	Communication/ technology transfer	Industry	Newsletter	AOL-3A	High
Australian Olive Industry R&D Workshop	1	Industry training and development	Development	R&D Planning	AOL-4A	High
Pruning Olive Trees After Year 2	3	Production	Systems	Management	AOL-5A	High
Research and Development and Production of Virus-tested Garlic, Garlic Seeds and Garlic By-products	2	Production	Breeding	Selection	BIO-1A	High
Gel-Pro Analyser Software	1	Production	Breeding	Selection	BOG-1A	Too early
The Selection of Sugarbeet Varieties Suitable for Commercial Cropping and Milling on Marginal Soils in the Burdekin and Mackay	1	Production	Breeding	Selection	CSR-1A	Medium
Feasibility and Profitability of Jojoba	1	Industry training and development	Development	Economic analysis	DAN-117A	Medium/High
Establishment of Preliminary Nutrient Standards for Jojoba Using Leaf Tissue Analysis	2	Production	Nutrition	Assessment	DAN-149A	Not known
A Screening Technique for the Rapid Selection of Suitable Jojoba Cultivars	2	Production	Breeding	Technique	DAN-65A	Not known
Preliminary Studies towards the Commercialisation of the Neem Tree in Australia	2	Industry training and development	Development	Economic analysis	DAQ-146A	Medium
To Undertake a Pre-feasibility Study to Assess the Market Potential and Establish the Commercial Viability for the Development of an Olive Industry in Australia	1	Industry training and development	Development	Economic analysis	DAQ-210A	High
Evaluation of the Commercial Potential of Sugarbeet on the Atherton Tableland	1	Industry training and development	Development	Economic analysis	DAQ-211A	Medium
An Investigation into the Commercial Potential of an Olive Industry in Australia - A Pilot Study	1	Industry training and development	Development	Economic analysis	DAS-37A	High
Investigation into the Commercialisation and Development of Ginseng	1	Industry training and development	Development	Economic analysis	DAT-22A	Medium
Commercial Production of Medicinal Herbs in Tasmania	2	Production	Production systems	Management	DAT-26A	Medium
Initial Investigation into the Commercialisation of Siberian Ginseng Eleutherococcus Senticosus	1	Industry training and development	Development	Economic analysis	DAT-28A	Medium
A cholesterol-lowering Extract from Garlic: Opportunities for an Australian Industry	1	Production	Breeding	Selection	DAV-124A	Medium/High
Increasing the Export Potential Opportunities for Australian Garlic	1	Production	Breeding	Evaluation	DAV-163A	High
The Utilisation of Seaweed as a Source of Omega-3 Fatty Acids and Beta-carotene	1	Processing	Complex	New properties	DAV-87A	Too early
Feasiblity Study of Salicornieae as Oil-seed Halophytes for Saline Land and Water	1	Production	Environmental sustainability	Salinity resistant	DAV-88A	Low
Discovering the Market Potential for Australian Jojoba Products	1	Markets	Market Research	Opportunities	HAS-4A	Medium/High

Olive Variety Assessment for Subtropical Summer Rainfall Regions	2	Production	Breeding	Evaluation	OAP-1A	Too early
Pre-Feasibility Studies for Manufacturing Selected Industrial Hemp Products in Australia	1	Markets	Market Research	Opportunities	PMP-1A	High
Economic Market Analysis of Fibre Crops in Australia	1	Industry training and development	Development	Economic analysis	PMP-2A	High
Australan Ginseng Research Program: Crop Establishment	1	Production	Reproduction/-establishment	Preparation	POP-1A	Medium/High
Realising the Potential of the Olive	3	Communication/ technology transfer	Industry	Publication	SAL-1A	High
National Olive Variety Assessment Project (NOVA)	3	Communication/ technology transfer	Industry	Networking	SAR-23A	Too early
Wild Olive Selection for Quality Oil Production	1	Production	Breeding	Selection	UA-41A	Too early
Monitoring the Relationship Between Olive Water Use and Yield	2	Production	Nutrition	Irrigation	UA-47A	Too early
Potential for Seed Gum Production Within Australia	1	Industry training and development	Development	Economic analysis	UCQ-12A	Low
Assessment of Olive Yield and Oil Quality and Cultivar Identification	1	Production	Breeding	Evaluation	UCS-19A	Too early
Food Colours from the Family Rubiaceae	2	Processing	Complex	New properties	UNS-7A	Low
Characterisation of Antiviral Compounds in Australian Bush Medicines	1	Processing	Complex	New properties	USA-5A	Too early
New High Quality Oil Seed Crops for Temperate and Tropical Australia	1	Production	Breeding	Evaluation	UWA-47A	Too early
Jojoba R&D Planning Workshop	1	Industry training and development	Development	R&D Planning	WS967-20	Medium/High
Second Hemp Workshop	1	Communication/ technology transfer	Industry	Seminars	WS967-24	Medium
Olive R&D Planning Workshop	1	Industry training and development	Development	R&D Planning	WS978-01	High
Hemp Industry Consultancy - Yorke Regional Development Board	1	Industry training and development	Development	Economic analysis	YRD-1A	Medium/High

Source: RIRDC database and files.

Medicinal and other extracts

Garlic — The main product in this area of the program has been garlic. It is about to graduate to being considered an established industry and will be covered by HRDC's vegetable levy in the future. The three projects have contributed to the success of the industry. They have all focused on breeding to improve the properties of the product.

- BIO-1A *Research and Development and Production of Virus-tested Garlic, Garlic Seeds and Garlic By-products* aimed to produce lines of garlic that were resistant to an insect borne virus that was causing problems in the industry. Biofresh (a company) proposed the project and it was hoped that if such a line was developed, then it would help overcome Chinese competition in the market. It was successful in doing this and there is now clean disease free stock, so the impact on the industry would have been high.
- DAV-124A *A Cholesterol Lowering Extract from Garlic: Opportunities for an Australian Industry* was proposed at the same time as BIO-1A and there was a lot of co-ordination between the two. There is a chemical called allicin that is found in garlic, which is known to be beneficial for cholesterol. This project aimed to breed garlic that produced high levels of this chemical and therefore develop a pharmaceutical market. It was successful, but required further work.

- DAV-163A *Increasing the Export Potential Opportunities for Australian Garlic* is a very new project that leads on and combines the findings from the previous two. The aim of this project is to provide further information on the yield benefits and pharmaceutical quality of virus-tested garlic.

Ginseng — has long been produced in Asia as a medicinal product. The research has focused on the feasibility — economic and productive — of producing ginseng commercially in Australia. There have been three projects.

- DAT-22A *Investigation into the Commercialisation and Development of Ginseng* looked at field trials, extension and investigative work. There has been a great deal of work in commercialising ginseng, but due to the long-term nature of the crop more investment in this work needs to be done. This project continued to interest potential and existing farmers, but further avenues need to be explored for its production.
- DAT-28A *Initial Investigation into the Commercialisation of Siberian Ginseng* looked at potential markets, requirements, sources of cultivars and establishing industry linkages. Siberian Ginseng was identified as an opportunity for investigation, which is seen as superior to other types. Germination of the seed in Australia was proven to be very difficult. However, it appears to be a viable alternative crop and contacts have been established. Both DAT-22A and DAT-28A should be evaluated together because of the links between them and while the program is in its early stages, the impact probably is medium. This is because there is a small ginseng industry in Tasmania with a lot of potential for growth.
- POP-1A *Australian Ginseng Research Program: Crop Establishment* looked at which areas in Australia were best suited to production, factors involved in germination and root dormancy, appropriate cultivars, etc. Locations were identified and should allow growers to progress to commercial size enterprises. Germination was also improved. It is judged to have had a medium/high impact.

Jojoba — five projects have been undertaken on jojoba. They are in a range of categories from industry development to production.

- DAN-117A *Feasibility and Profitability of Jojoba* was stimulated by the need for crops that will grow in recharge zones to assist in reducing the water table. ABARE, on behalf of the Murray Darling Basin Commission, were conducting a project on the use of three types of crops (one being jojoba) in recharge zones. This work includes analysing the impact of increased production of these shrubs on market trends and examining the profitability of farming the three shrubs in the region. This project aimed to assist ABARE in these two aims by providing background information. Also the project was to disseminate information on management and marketing to the public through advisory publications. The ABARE publication is often quoted and discussed, so the impact is probably medium/high.
- WS967-20 *Jojoba R&D Planning Workshop* brought together producers, government officers and researchers from New South Wales and WA to assess where the industry is at and where it is going. A better understanding between RIRDC and the industry was established on each party's needs and status. This understanding has meant that proposals to RIRDC have been improved and this has benefited the industry. It has been judged to have a medium/high impact.
- HAS-4A *Discovering the Market Potential for Australian Jojoba Products* was a spin-off from the above workshop where it was recognised that there is still a lack of knowledge for intending growers in Australia about the market potential for Australian Jojoba products. This project therefore investigated the existing potential domestic and overseas market for Australian Jojoba products. Various markets were identified, but concerns exist about an over supply in Australia and the difficulty of competing in world markets. Nevertheless, future strategies were developed and these have the potential to have a medium/igh impact on the industry.

- DAN-65A *A Screening Technique for the Rapid Selection of Suitable Jojoba Cultivars* investigated the variability in production of Jojoba. This was a problem, as consistency needs to be achieved if the crop is to become successful. Prior to this project, a study tour of North America provided an opportunity to assess variability and collect seed material for evaluation in Australia. This project establishes a screening technique for the selection of cultivars. There were limitations in using this model, however it is still useful for predicting suitable climatic areas to grow jojoba in Australia.
- DAN-149A *Establishment of Preliminary Nutrient Standards for Jojoba Using Leaf Tissue Analysis*.

Rubiaceae — One project has been undertaken looking at processing. UNS-7A *Food colours from the family rubiaceae* aimed at extracting food dyes from rubiaceae, but the impact of it was quite low. This is because the research was not effectively executed, leading to poor results and communication.

Seaweed — An early project was undertaken on seaweed. Seaweed projects are now funded by the Fisheries R&D Corporation. OFA and BC have been identified as having beneficial effects to people's health, and several studies have indicated that seaweed could be used as a reliable source of OFA. DAV-87A *The Utilisation of Seaweed as a Source of Omega-3 Fatty Acids and Beta-carotene* aimed to identify the best seaweed types for these chemicals, as well as developing a market for seaweed. Chemical levels were found to be high, while toxin levels were found to be low. This project attracted international interest, indicating that it is of high value and a working seaweed network has been established. The Japanese team continued working on this project after RIRDC's involvement, confirming the economic potential of this product. There was a commercial agreement established between a Japanese company and the Victorian Department of Agriculture. The NPP (New Plant Program) Review (Downton, Evans and Field 1997) at the time said that it was too early to judge what sort of impact this has had on industry, and would need to revisit it in 2001. So it is too early to judge.

Seed gum — UCQ-12A *Potential for Seed Gum Production within Australia* is still in progress. It is a preliminary costing of production, based on data from the field studies, indicating that commercial production require substantial increases on the yield of seed achieved on 'wild' stands. There was strong industry sponsorship, but the findings have had a low impact.

Sugarbeet — Two projects have been undertaken on sugarbeet.

- DAQ-211A *Evaluation of the Commercial Potential of Sugarbeet on the Atherton Tableland* has shown that there is sufficient promise for sugarbeet in the Atherton Tableland and this can be seen from the fact that the Queensland Department of Agriculture has contributed further funds to it. RIRDC are still waiting for a final report, but the prospect of further research means that this project has had a medium impact.
- CSR-1A *The Selection of Sugarbeet Varieties Suitable for Commercial Cropping and Milling on Marginal Soils in the Burdekin and Mackay* tested the viability of sugar beet in these areas. In previous work it has been shown that sugarbeet has a higher yield than sugar cane. However, lack of infrastructure has prevented its adoption. The infrastructure exists in Northern Australia and this project was aimed to see if sugarbeet was suitable for production in the tropics. This concluded that there is little potential for sugarbeet in the Burdekin and the Mackay where sugar yields from sugarcane will exceed those for sugarbeet. Further research on sugarbeet should focus on areas where sugarbeet could be rotated with summer crops. This has probably had a medium impact.

Medicinal herbs — DAT-26A *Commercial Production of Medicinal Herbs in Tasmania* assessed the commercial potential of medicinal herbs and developed agronomy packages, established a herb network, and implemented a seed collection system of superior genetic material. It is assessed as having a medium impact.

Bush medicines — USA-5A *Characterisation of Antiviral Compounds in Australian Bush Medicines* has only recently been completed. A database for plants for use as a source of medicines has been developed in order to isolate and identify the chemical structure of anti-viral compounds from Australian bush medicine plants.

Neem — Extracts from the neem seed have been shown to possess insecticidal properties and there is considerable interest from primary producers in establishing neem plantations in northern Australia. At the time of the project there was no industry organisation, and prospective producers were having difficulty on finding information on the potential economic viability of the neem tree.

- DAQ-146A *Preliminary Studies Towards the Commercialisation of the Neem Tree in Australia* was initiated to address some of these unknowns. Results were disappointing, with the chemical make-up and biological efficacy was disappointing. The economic analysis of production costs suggested that the cultivation of the neem seed is not currently profitable in Australia and the NPP Review points out that this allows investors to now make an informed choice, judging that the impact on industry of this project was satisfactory. The overall impact of the project is judged to be medium.
- DAQ-59A *Clonal Propagation of Neem (Azadarachita) and Field Testing Azadarachtin in Some Vegetable Crops* was listed in the NPP review. It is not included in the tables or charts as little is known about this project.

Olives

Olives are a major area in this category of projects, with 15 projects. The emphasis has been on industry development and communication, and more recently on production issues.

Industry development — Four projects have been undertaken, two on R&D planning and two which conducted an economic analysis.

- DAS-37A *An Investigation into the Commercial Potential of an Olive Industry in Australia- A Pilot Study* was part of RIRDC's very early work on olives. Olives were thought to have a lot of potential for import substitution for the growing vegetable oil market. The pilot study aimed to evaluate the feasibility of both Australian and overseas production methods and to determine the R&D requirements to expand the industry. The results were favourable, indicating that olive oil can be commercially grown, but the correct choice of cultivars needs to be made at the beginning. Three publications were produced and there has been a very high demand for these. The impact is judged to be high.
- DAQ-210A *To Undertake a Pre-feasibility Study to Assess the Market Potential and Establish the Commercial Viability for the Development of an Olive Industry in Australia* was an excellent study looking at market prospects (both domestic and international) and consumer attitudes, with a very high impact. The study was quite cautionary, suggesting that there was likely to be a huge increase in olive oil production in Australia and that alternative strategies would be needed to deal with this.
- WS978-01 *Olive R&D Planning Workshop* and AOL-4A *Australian Olive Industry workshop* were used to develop the current R&D Plan for olives. The first project was more a drafting stage and the second was a consultative process with state bodies of the Australian Olive Association. The R&D plan is a very important document and it is adhered to very strictly by RIRDC. Therefore these projects would have had a high impact. The consultative process also has facilitated industry communication.

Communication — Four communication projects have been undertaken.

- AOL-1A *Australian Olive Association Conferlinking* is a small project that is very important in helping to coordinate the efforts to evaluate and identify varieties in different parts of the country. This is because there may be problems of identifying plants for nurseries, etc. that may have fair trading implications. Even though it is still going, it is possible to say that this is having at least a medium impact.
- SAR-23A *National Olive Variety Assessment Project* will develop a nationally coordinated technical and educational support network for the assessment of olives. It has just started so it is too early to judge what the impact might be.
- AOL-3A *OLIVEAUS-Australian Olive Association Magazine* provided assistance to the Olive Association to produce their quarterly magazine. This magazine provides technical information as well as information on research in progress. This is very useful because there has been an influx of people into the industry who do not necessarily possess the skills required. There is a high level of industry contribution and it is judged to have had a high impact on the industry.
- SAL-1A *Realising the Potential of the Olive* was a conference in response to substantial interest in the olive industry has been generated and demand for information on investment in olives is substantial. The conference provided this information in a very even-handed manner. A draft R&D plan was disseminated and the main issues to come out of the conference were that the Australian Olive Industry needs to: ensure industry structures have representation from all stages of the supply chain, develop strategies for market entry, conduct research into the table olive oil market. The conference was well attended, especially by prospective investors, and is judged to have had a very high impact.

Production — Seven projects have looked at aspects of production.

- UA-41A *Wild Olive Selection for Quality Oil Production* and BOG-1A *Gel-Pro Analyser Software* are two related projects. The second of these projects was for the purchase of software used in the first. The first project assessed wild olive species that exist in Australia for their commercial potential. These olive varieties are descendants of varieties that were brought to Australia during colonial times and have since hybridised. This may mean that they are particularly suitable to Australia's climate and soil. This project is making some good progress, and is guided by the Conferlinking project mentioned above. However, it is too early to say what impact it is having.
- OAP-1A *Olive Variety Assessment for Subtropical Summer Rainfall Regions* is a complimentary project to the *National Olive Assessment Project*. It is looking at olives in Queensland, but it is too early to judge what sort of impact it will have.
- UCS-19A *Assessment of Olive Yield and Oil Quality and Cultivar Identification* is closely related to UA-41A. It is involved with developing tools to correctly identify varieties with good potential in terms of yield and quality. It is too early to say what sort of impact it might have.
- UA-47A *Monitoring the Relationship Between Olive Water Use and Yield* was aimed at trying to determine the optimal water regime for olives. This information is largely unknown at the moment, but is important because water is becoming an increasingly scarce and expensive resource.
- AOL-2A *Olive Pruning Video* and AOL-5A *Pruning Olive Trees After Year 2 (Video)* were extension exercises, not just for the practice of pruning, but also covered broader aspects of the establishment of olives. They were initiated again due to the recognition that there were elements in the industry that did not have the required expertise. It is believed that there was and still is a high demand for these videos.

Oilseeds

Two projects have been undertaken.

- UWA-47A *New High Quality Oil Seed Crops for Temperate and Tropical Australia* is exploratory work is still in progress. It was initiated to find alternative varieties to canola which, while a very successful crop, does not grow on all types of soils. It is looking at the edible, industrial and pharmaceutical markets and is too early to tell if it is going to have an impact.
- DAV-88A *Feasibility Study of Salcorniaea as Oil-seed Halophytes for Saline Land and Water* was undertaken in the search for crops that grow on saline soils. Salcorniaea has been shown in Arizona to have a high oil yield when irrigated with seawater. This means that it might work on saline land in Australia that contributes nothing to the economy at the present point in time. This project was aimed at determining if it was suitable for production in Australia. All efforts for field establishment were unsuccessful and technical and execution problems meant that the project had a low impact.

Fibre

Hemp — Three projects have been undertaken on hemp.

- YRD-1A *Hemp Industry Consultancy-Yorke Regional Development Board* looked at market opportunities, crop production, primary processing, technology and the status of current initiatives in Australia. It examined the feasibility of a hemp industry and contributed to a national workshop. It was very valuable information and lead to some re-evaluation by elements within the industry that were perhaps too optimistic about the prospects for an industry.
- PMP-1A *Pre-Feasibility Studies for Manufacturing Selected Industrial Hemp Products in Australia* was commissioned because there was a lot of interest in hemp production, and there was little certainty as to what the prospects were. It concluded that there was a small market for textiles, but this was about it. It led to a publication and has had a high impact on the policies of RIRDC in the area.
- WS967-24 *Second Hemp Workshop* was a small workshop that brought together researchers working on hemp fibre. The impact has probably been medium. This is because useful discussions were had, and it allowed researchers to interact. Also it was concluded that the hemp industry was quite limited, so this conclusion will affect future research.

Flax — AMA-1A *Establishment of a Flax Fibre Industry in Australia* was undertaken because there was a lot of interest in flax in Australia, for use as a fibre and oil source. It showed that there was some potential, but no much. This has meant that there hasn't been any further development in this area, and so the project has had a medium impact.

Plant fibre — PMP-2A *Economic Market Analysis of Fibre Crops in Australia* followed on from previous work that looked at hemp but not other bast fibres. This project was designed to identify opportunities in Australia to produce non-wood fibres and develop non-wood fibre products and to determine which products are most suited to development in Australia. The project suggested that any potential market would only be very tiny and restricted, and that further investment or R&D in the area should be viewed very cautiously. Therefore it has had a high impact.

Prospective fruit, vegetable and nut crops

There have been 62 projects undertaken that are classified as prospective fruit, vegetable and nuts. The total cost of these projects is $17.5 million of which 33 per cent has been funded by RIRDC. Fruit has been the largest area, with total funding of $8.4 million of which 30 per cent has been funded by RIRDC. Nuts is next, with $7.3 million, of which 39 per cent has been funded by RIRDC. Vegetables has attracted $1.8 million in research funds, of which 24 per cent has been contributed by RIRDC.

The projects are listed in table 3.13.

Classification

The projects are distributed across the various categories. The classification is illustrated in chart 3.14, which shows the links between projects, and summarised in table 3.15.

Initial assessment

The initial assessment is based on the project manager's judgement of the outcome of the project. A summary of each project group, as set out in chart 3.14 is provided. Most of the projects undertaken have been applicable across the range of products in the bushfood industry, only a few have focused on specific products. Table 3.15 summarises the assessment.

3.13 **Projects — timing and funding Prospective fruit, vegetable and nut crops**

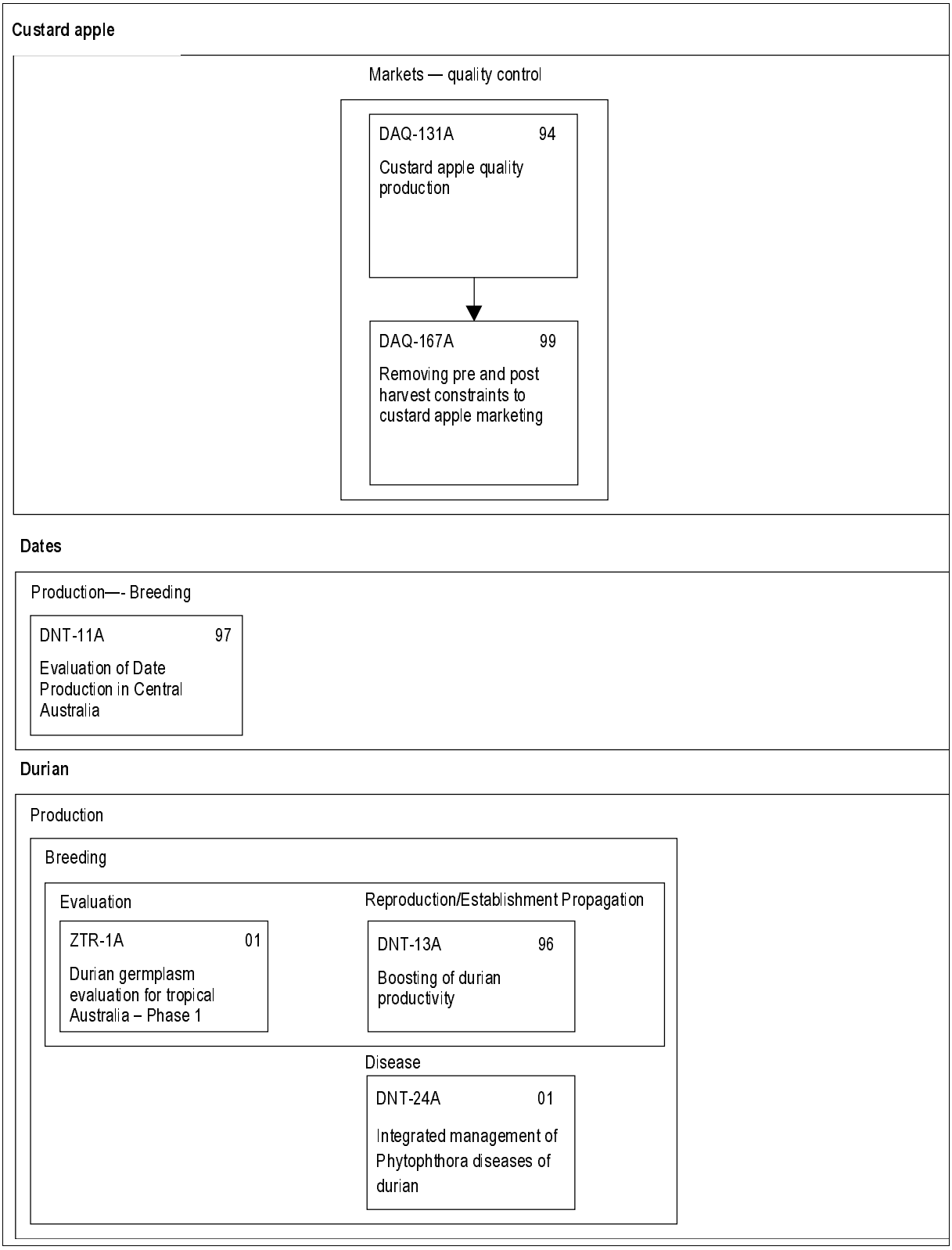
Project	*Code*	*Start date*	*Finish date*	*RIRDC total*	*Industry total*	*Research organisation total*	*Total*
Business and Strategic Plan for the Lychee Industry	ALG-1A	1/12/97	30/04/98	5 000	—	—	5 000
Consultancy: Market Study for Tropical Fruits, Vegetables and Nuts	AMR-4A	—	30/06/97	29 000	0	0	29 000
New Salad and Vegetable Crops from Sub-Antarctic Islands	ANC-2A	—	1/06/98	37 147	—	14 918	52 065
Development of Quality Management Systems (QMS) for the Australian Wwalnut Industry	AWI-1A	15/06/97	30/06/98	15 000	—	—	15 000
Securing and Maintaining Cashew Germplasm at Howard Springs NT	BRI-1A	—	31/12/01	17 500	0	0	17 500
Biological and Chemical Management of the Giant Termite, Mastotermes Darwiniensis	CSE-23A	—	30/06/93	32 709	26 500	0	59 209
Genetic Improvement of Cashew through Hybridisation	CSH-36A	—	30/06/93	222 527	27 000	450 471	699 998
Ensuring the Long Term Future of the Pistachio Industry by Development of Procedures to Overcome Problems Associated with Dormancy and Disease	CSH-37A	—	30/06/92	53 363	1 000	0	54 363
Regulation of Cropping in Lychee	CSH-40A	—	31/03/98	95 080	3 000	424 105	522 185
Cashew Fingerprinting Study	CSH-41A	—	—	5 000	0	14 500	19 500
Evaluation of Growth Habit, Yield and Nut Weight and Shelling Percentage of Cashew Hybrids Planted at Three Test Sites	CSH-43A	—	30/06/96	337 521	190 687	377 047	905 255
Evaluation of Growth Habit, Flowering Behaviour and Yield of Cashew Hybrids and Layout of Replicated Trials with Some High Yielding Hybrid Selections (Third Phase of RIRDC Project CSH-43A)	CSH-48A	—	30/05/98	158 236	64 870	159 993	383 099
Development of an Australian Cashew Industry Information Support System	CSL-1A	15/04/97	30/08/98	29 207	800	70 959	100 966
Field Validation of 'Best Bet' Fertiliser Management Strategies for Cashews in North Queensland	CSO-11A	—	30/06/98	25 896	6 000	24 600	56 496

Evaluation of Growth Habit, Flowering Behaviour and Yield of Cashew Hybrids and Layout of Progeny Trials with Some High Yielding Hybrid Selections (Final Phase of Breeding Project)	CSP-6A	1/07/98	30/06/01	324 396	95 520	778 502	1 198 418
Improved Post-harvest Handling f Lychee	CSP-7A	1/01/99	30/10/01	210 000	0	300 248	510 248
Commercial Evaluation of Lima Beans and Sugar Snap Peas	DAQ-109A	—	30/06/93	52 433	0	0	52 433
Control of Production Patterns in Tropical Fruit	DAQ-116A	—	30/06/94	116 245	9 000	86 101	211 346
The Potential for Mixed Transport of Selected Tropical Fruit	DAQ-117A	—	30/06/94	69 850	0	108 590	178 440
Lychee Postharvest Handling and Marketing	DAQ-129A	—	30/06/94	143 575	16 000	260 301	419 876
Custard Apple Quality Production	DAQ-131A	—	30/06/94	115 890	6 500	213 978	336 368
Tissue Culture Development of a Tropical Asparagus Super-clone	DAQ-138A	—	30/06/96	8 987	3 750	178 327	191 064
Germplasm Conservation of Minor Tropical Field Crops	DAQ-140A	—	30/06/95	39 900	0	0	39 900
Cashew Nutrition Management Strategies	DAQ-145A	—	31/10/98	109 481	6 450	194 425	310 356
Removing Pre and Post Harvest Constraints to Custard Apple Marketing	DAQ-167A	—	25/02/99	99 700	155 662	328 287	583 649
Improved Canopy Management to Maximise Market Opportunities for the Tree Crops Lychee, Longan and Rambutan (Sapindaceae)	DAQ-177A	—	29/10/99	467 008	107 000	798 398	1 372 406
Developing a Postharvest Handling and Storage Strategy for Longan	DAQ-249A	1/07/98	30/06/01	86 643	7 500	215 760	309 903
Enhancing Fruit Yield and Quality of Rambutan and Longan by Optimising Irrigation and Nutrition Management Systems — QLD	DAQ-251A	1/07/98	30/09/01	75 000	33 750	245 235	353 985
Cashew Nutrition Management Studies II	DAQ-257A	1/06/99	31/05/01	67 830	2 000	294 693	364 523
Market Opportunity Identification and Analysis of the Domestic Market for Australian Longans and Rambutans	DAQ-260A	1/11/99	30/10/00	46 090	7 250	30 640	83 980
Improved Postharvest Handling and Storage of Specialty Mushrooms	DAV-123A	—	30/06/97	13 621	300	7 070	20 991
Walnut Industry Research and Best Practice Implementation	DAV-164A	23/07/99	1/06/02	182 712	0	36 541	219 253
High Yields and Early Bearing for Walnuts and Quality Timber	DAV-73A	—	30/09/99	305 908	61 062	204 655	571 625
Improved Quality and Marketability of Chestnuts by the Control of Phomopsis Nut Rot and the Extension of Storage Life	DAV-81A	—	30/06/96	66 000	80 248	96 486	242 734
Nutrition Studies of Cashew on Cununurra Clay at the Ord River Irrigation Area (ORIA), Kununurra, Western Australia	DAW-29A	1/07/90	31/12/93	117 356	72 403	32 460	222 219
Environmental Factors in Influencing the Growth and Yield Rambutans and Cupuacu	DNT-10A	1/06/92	30/06/95	82 850	0	153 870	236 720
Evaluation of Date Production in Central Australia	DNT-11A	1/07/92	3/12/97	87 432	0	374 613	462 045
Boosting of Durian Productivity	DNT-13A	1/07/93	30/07/96	43 887	0	276 535	320 422
Productivity Responses of Asparagus to Droughting in a Tropical Environment	DNT-17A	1/07/94	1/08/99	52 521	12 040	171 837	236 398
Integrated Management of Phytophthora Diseases of Durian	DNT-24A	1/07/98	30/06/01	108 000	15 000	844 836	967 836

Nutrition and Irrigation Management of Rambutan for Maximisation of Yield and Quality — Northern Territory	DNT-26A	1/07/98	30/06/01	54 502	24 000	135 712	214 214
Evaluation of the Potential of Growing Tuber Melanosporum as a Crop on Mainland Australia for Export and Domestic Consumption.	DPS-1A	1/07/95	22/01/97	17 500	—	36 000	53 500
The Impact and Control of Lychee Pepper Spot in Australia	DRW-1A	1/01/99	23/03/98	13 000	0	0	13 000
Strategic Planning — Longan Industry	LGA-1A	4/10/97	4/10/98	5 030	—	—	5 030
Cashew Program Review and Workshop — Kuranda 1996	MS967-09	1/07/96	30/06/97	21 133	—	—	21 133
The Establishment of Economics Injury Levels and Control Methods for the Key Cashew Insect Pests	NAB-4A	1/07/89	30/06/98	52 000	37 466	0	89 466
The establishment and production of the French black truffle Tuber melanosporum in Tasmania	PTT-1A	1/08/93	1/06/93	215 437	479 330	0	694 767
(Extension) The Establishment and Production of the French Black Truffle Tuber Melanosporum in Tasmania	PTT-2A	1/10/98	30/09/00	30 000	480 800	0	510 800
Strategic Plans for the Australian Rambutan and Mangosteen Industries	RTE-1A	15/09/97	30/12/97	4 112	—	—	4 112
An Evaluation of Australian Hazelnut Varieties with Respect to Physical and Nutritional Characteristics and Storage Potential	ULA-11A	1/09/92	31/08/94	56 665	500	30 921	88 086
A Study of Sweet Potato Viruses in Northern Territory Sweet Potato Crops	UNT-2A	1/01/91	31/12/93	59 128	0	0	59 128
The Effect of Native Vegetation on the Cashew Arthropod Fauna with Particular Reference to the Most Important Pest — Helopeltis	UNT-3A	11/06/93	30/06/96	49 359	0	179 404	228 763
Utilisation of the Green Ant, Oecephylla Smaragdina, to Control Cashew Insect Pests	UNT-4A	1/01/96	30/07/99	170 388	0	456 810	627 198
Continuation of Transplanted Green Ant Colony Monitoring and Implementation of the Ant Technology in Commercial Cashew Plantations	UNT-5A	1/01/99	30/12/00	141 346	0	21 259	162 605
Developing the Non-astringent Persimmon Industry as an Export Industry for Australia — Final Stage	UQ-21A	1/07/92	30/06/94	61 777	2 040	38 454	102 271
The Role of Parasites and Predators in Cashew Pest Control: Development of an Integrated Pest Management Programme	UQ-24A	1/07/92	30/07/01	147 962	45 707	120 494	314 163
A Field Evaluation of the Productivity of Hazelnut Varieties	US-74A	1/07/98	1/06/03	89 600	22 450	74 380	186 430
A Field Evaluation of the Productivity of Hazelnut Varieties	USO-1A	1/10/94	30/09/98	85 115	26 800	40 578	152 493
Speciality Mushroom Production Systems: Maitake and Morels	UT-30A	1/07/99	30/06/04	243 859	80 000	65 846	389 705
The Postharvest Browning of Rambutans Grown in the Northern Territory	UWS-2A	1/07/92	30/06/00	19 360	2 000	113 200	134 560
Market Prospects and Research Priorities for Commercially Under-Exploited Tropical Fruits, Vegetables and Nuts	WS967-19	15/07/97	16/07/97	26 027	—	—	26 027
Durian Germplasm Evaluation for Tropical Australia Phase 1	ZTR-1A	1/07/96	30/06/01	106 870	283 000	103 320	493 190

Source: RIRDC database and files.

3.14 Projects — classification and initial assessment Prospective fruit, vegetables and nut crops



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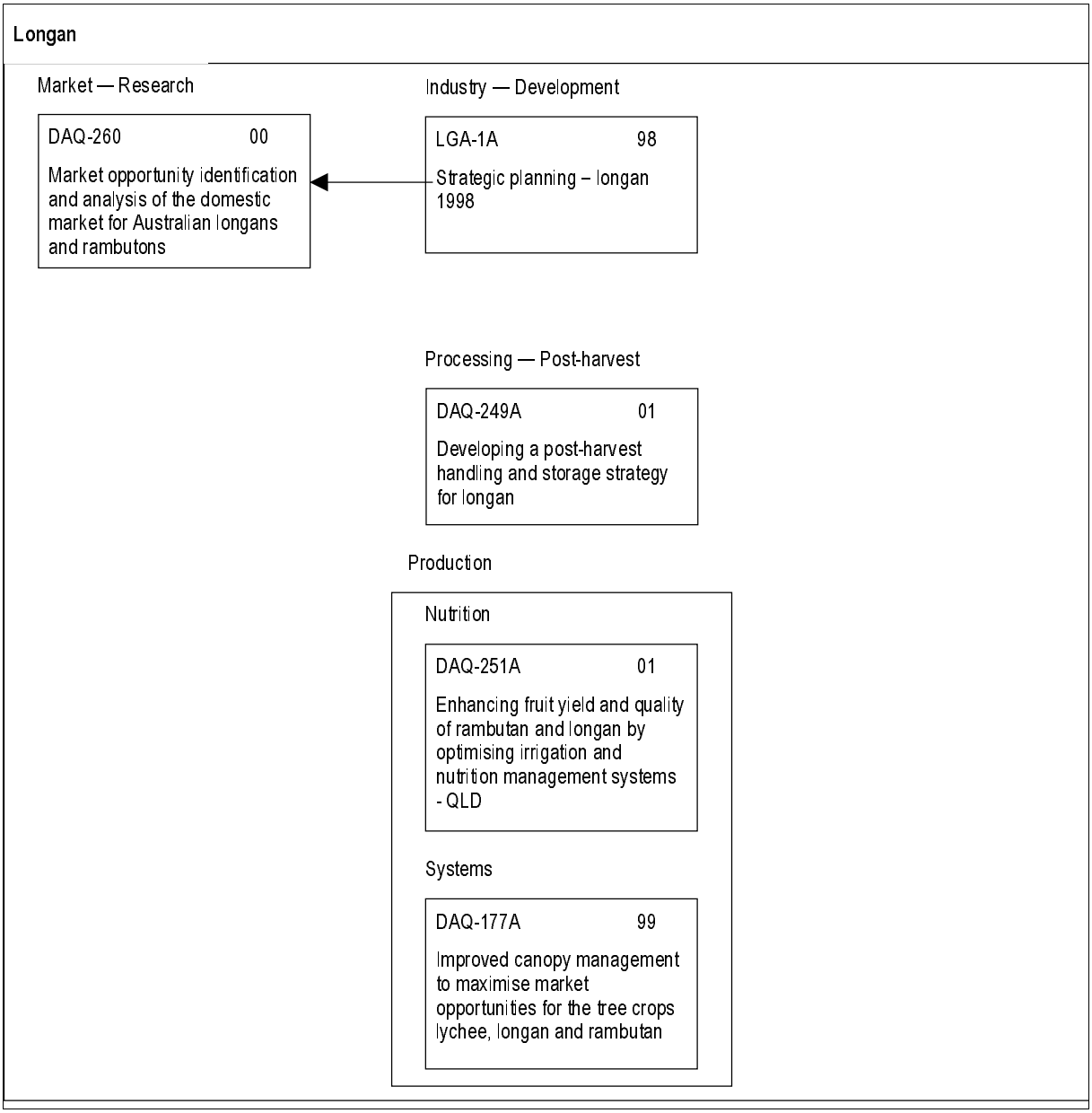
3.14 **Projects — classification and initial assessment Prospective fruit, vegetables and nut crops** (Continued)



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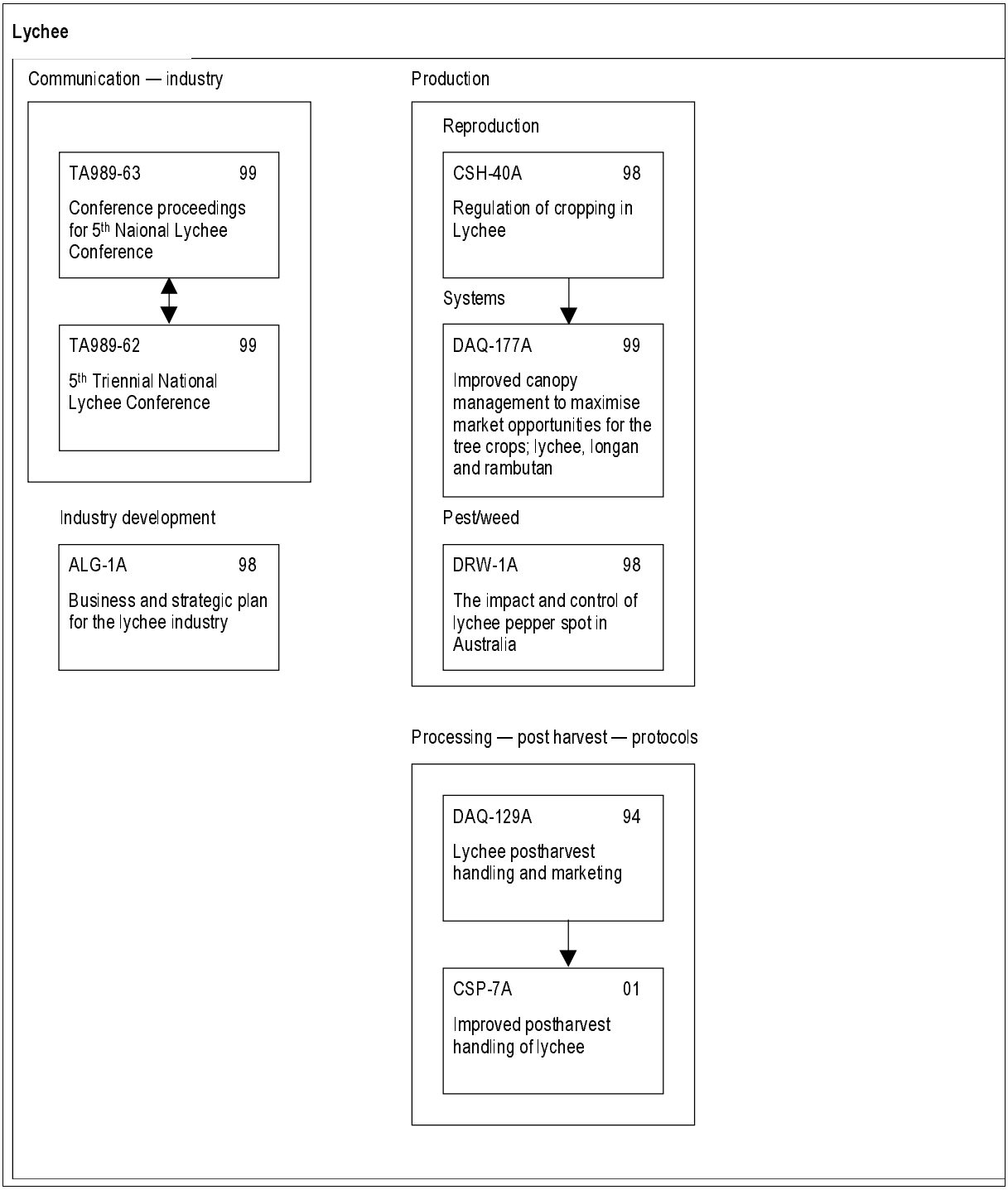
3.14 **Projects — classification and initial assessment Prospective fruit, vegetables and nut crops** (Continued)



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3.14 **Projects — classification and initial assessment Prospective fruit, vegetables and nut crops** (Continued)

Persimmon

Production/processing/markets

UQ-21A 94

Developing the non-astringent Persimmon Industry as an export industry for Australia

Rambutan

Production

Disease/systems

DNT-10A 95

Environmental factors in influencing the growth and yield

Nutrition — irrigation

DNT-26A 01

Nutrition and irrigation management of rambutan for maximisation of yield and quality —- NT

DAQ-251A 01

Enhancing fruit yield and quality of rambutan and longan by optimising irrigation and nutrition management systems — QLD

Industry — development

RTG-1A 97

Strategic plans for the Australian rambutan and mangosteen industries

Processing — post harvest

UWS-2A 00

The post harvest browning of Rambutans growing in the NT

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3.14 **Projects — classification and initial assessment Prospective fruit, vegetables and nut crops** (Continued)

	I	II	III
Tropical fruits			
Industry — development	WS967-19 97 Market prospects and research priorities for commercially under-exploited tropical fruits, vegetables and nuts	Distribution — transportation DAQ-117A 94 The potential for mixed transport of selected tropical fruit	
Production — breeding	Selection DAQ-116A 94 Control of production patterns in tropical fruit	Germplasm conservation DAQ-140A 95 Germplasm conservation of minor tropical field crops	
Markets — research	Opportunities AMR-4A 97 Consultancy market study of tropical fruits, vegetables and nuts		

(Continued on next page)

3.14 **Projects — classification and initial assessment Prospective fruit, vegetables and nut crops** (Continued)

I II III

Asparagus

Production

Breeding

DAQ-138A 96
Tissue culture development of a tropical asparagus superclone

Nutrition

DNT-17A 99
Productivity responses of asparagus to droughting in a tropical environment

Lima Beans and Sugar Snap Peas

Production — breeding

DAQ109A 93
Commercial evaluation of lima beans and sugar snap peas

Sub-Antartic species

Production — systems/market research

ANC-2A 98
New salad and vegetable crops from sub-Antarctic islands

(Continued on next page)

3.14 Projects — classification and initial assessment Prospective fruit, vegetables and nut crops (Continued)

Sweet potato

Production — disease

UNT-2A 93
A study of sweet potato viruses in Northern Territory sweet potato

Mushrooms

Production — systems

UT-30A 04
Specialty mushroom production systems: maitake and morels

Market — research

UT-12A 97
Preliminary investigation on 'French' black morel cropping (*Marchella angusticeps*)

Processing — post harvest

DAV-123 97
Improved post harvest handling and storage of specialty mushrooms

Truffles

Production — systems

Viability

DPS-1A 97
Evaluation of the potential of growing tuber *Melanosporum* as a crop on mainland Australia for export and domestic consumption

PTT-1A 93
The establishment and production of the French black truffle tuber *Melanosporum* in Tasmania

PTT-2A 00
(Extension) the establishment and production of the French black truffle tuber *Melaosporum* in Tasmania

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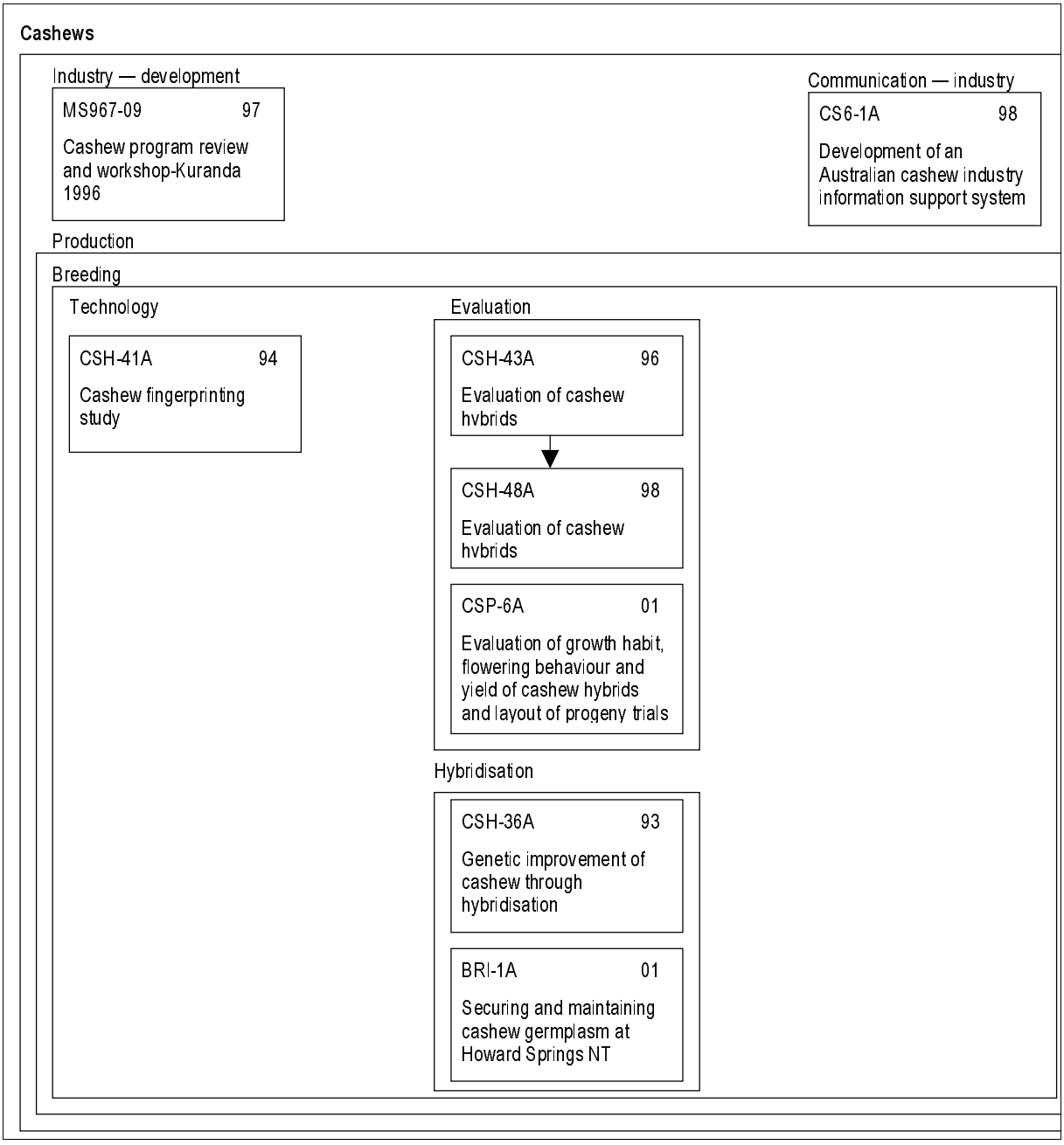
3.14 **Projects — classification and initial assessment Prospective fruit, vegetables and nut crops** (Continued)



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3.14 Projects — classification and initial assessment Prospective fruit, vegetables and nut crops (Continued)

Production **(continued)**

Nutrition

Management

DAQ-145A 98

Cashew nutrition management strategies

DAQ-257A 01

Cashew nutrition management strategies II

Fertiliser

CSO-11A 98

Field validation of 'best bet' fertiliser management strategies for cashews in North Queensland

Nutrition

DAW-29A 93

Nutrition studies of cashew on Canurra clay at the Ord River irrigation area

Pest/weed

Biological control

UNT-3A 96

The effect of native vegetation on the cashew arthropod fauna

UNT-4A 99

Utilisation of the green ant to control cashew insect pests

UNT-5A 00

Continuation of transplanted green ant colony monitoring and implementation of the ant technology

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3.14 **Projects — classification and initial assessment Prospective fruit, vegetables and nut crops** (Continued)

Production **(continued)**

Pest/weed (continued)

Assessment

NAB-4A 98

The establishment of economic injury levels and control methods for key cashew insect pests

IPM

UG-24A 01

The role of parasites and predators in cashew pest control: development of an IPM

Chestnuts

Processing — Post-Harvest

DAV-81A

Improved quality and marketability of chestnuts by the control of phompsis nut rot and the extension of storage life

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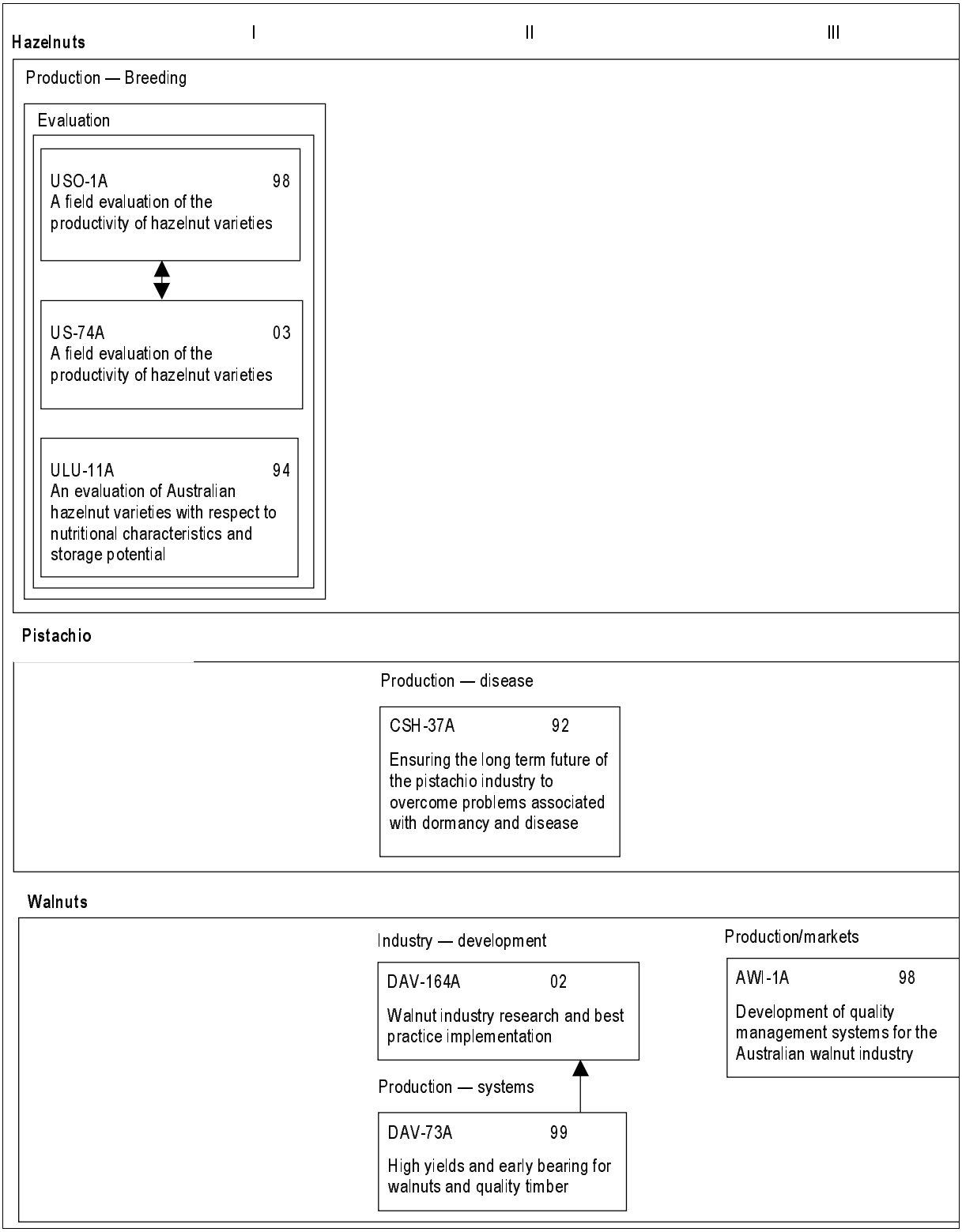
3.14 **Projects — classification and initial assessment Prospective fruit, vegetables and nut crops** (Continued)



3.15 Projects — classification and initial assessment Prospective fruit, vegetables and nut crops

Project	*Stage*	*Level 1*	*Level 2*	*Level 3*	*Code*	*Evaluation*
Business and Strategic Plan for the Lychee Industry	1	Industry training and development	Development	Industry planning	ALG-1A	High
Consultancy: Market Study for Tropical Fruits, Vegetables and Nuts	1	Markets	Market research	Opportunities	AMR-4A	High
New Salad and Vegetable Crops from Sub-Antarctic Islands	2	Production Markets	Systems Market Research	Viability Opportunities	ANC-2A	Too early
Development of Quality Management Systems (QMS) for the Australian Walnut Industry	3	Production Markets	Systems Quality control	Management Quality management systems	AWI-1A	Medium/High
Securing and Maintaining Cashew Germplasm at Howard Springs NT	2	Production	Breeding	Hybridisation	BRI-1A	
Biological and Chemical Management of the Giant Termite, Mastotermes Darwiniensis	2	Production	Pest/weed	Management	CSE-23A	Not known
Genetic Improvement of Cashew Through Hybridisation	2	Production	Breeding	Hybridisation	CSH-36A	Not known
Ensuring the Long Term Future of the Pistachio Industry by Development of Procedures to Overcome Problems Associated with Dormancy and Disease	2	Production	Disease	Management	CSH-37A	Not known
Regulation of Cropping in Lychee	2	Production	Reproduction	Propogation	CSH-40A	High
Cashew Fingerprinting Study	1	Production	Breeding	Technology	CSH-41A	Not known
Evaluation of Growth Habit, Yield and Nut Weight and Shelling Percentage of Cashew Hybrids Planted at Three Test Sites	2	Production	Breeding	Evaluation	CSH-43A	Not known
Evaluation of Growth Habit, Flowering Behaviour and Yield of Cashew Hybrids and Layout of Replicated Trials with Some High Yielding Hybrid Selections (Third Phase of RIRDC Project CSH-43A)	2	Production	Breeding	Evaluation	CSH-48A	Not known
Development of an Australian Cashew Industry Information Support System	3	Communication/technology transfer	Industry	Information systems	CSL-1A	Not known
Field Validation of 'Best Bet' Fertiliser Management Strategies for Cashews in North Queensland	2	Production	Nutrition	Fertiliser	CSO-11A	Not known
Evaluation of Growth Habit, Flowering Behaviour and Yield of Cashew Hybrids and Layout of Progeny Trials with Some High Yielding Hybrid Selections (Final Phase of Breeding Project)	2	Production	Breeding	Evaluation	CSP-6A	Not known
Improved Post-harvest Handling of Lychee	2	Processing	Post harvest	Protocols	CSP-7A	Too early
Commercial Evaluation of Lima Beans and Sugar Snap Peas	2	Production	Breeding	Evaluation	DAQ-109A	Not known
Control of Production Patterns in Tropical Fruit	1	Production	Breeding	Selection	DAQ-116A	Medium
The Potential for Mixed Transport of Selected Tropical Fruit	2	Distribution, etc.	Transportation	Mixed loads	DAQ-117A	Medium
Lychee Postharvest Handling and Marketing	2	Processing	Post harvest	Protocols	DAQ-129A	High
Custard Apple Quality Production	2	Markets	Quality control	Quality management	DAQ-131A	High
Tissue Culture Development of a Tropical Asparagus Super-clone	1	Production	Breeding	Technology	DAQ-138A	Low
Germplasm Conservation of Minor Tropical Field Crops	2	Production	Breeding	Germplasm conservation	DAQ-140A	Not known

Cashew Nutrition Management Strategies	2	Production	Nutrition	Management	DAQ-145A	
Removing Pre and Post Harvest Constraints to Custard Apple Marketing	2	Markets	Quality control	Quality management	DAQ-167A	Not known
Improved Canopy Management to Maximise Market Opportunities for the Tree Crops Lychee, Longan and Rambutan (Sapindaceae)	2	Production	Systems	Management	DAQ-177A	High
Developing a Postharvest Handling and Storage Strategy for Longan	2	Processing	Post harvest	Protocols	DAQ-249A	Too early
Enhancing Fruit Yield and Quality of Rambutan and Longan by Optimising Irrigation and Nutrition Management Systems — QLD	2	Production	Nutrition	Irrigation Fertilizer	DAQ-251A	Too early
Cashew Nutrition Management Studies II	2	Production	Nutrition	Management	DAQ-257A	Not known
Market Opportunity Identification and Analysis of the Domestic Market for Australian Longans and Rambutans	1	Markets	Market Research	Domestic	DAQ-260A	High
Improved Postharvest Handling and Storage of Specialty Mushrooms	2	Processing	Post harvest	Protocols	DAV-123A	High
Walnut Industry Research and Best Practice Implementation	2	Industry training and development	Development	Benchmarks	DAV-164A	Too early
High Yields and Early Bearing for Walnuts and Quality Timber	2	Production	Systems	Management	DAV-73A	High
Improved Quality and Marketability of Chestnuts by the Control of Phomopsis Nut Rot and the Extension of Storage Life	2	Processing	Post-harvest treatment	Shelf life	DAV-81A	Medium
Nutrition Studies of Cashew on Cununurra Clay at the Ord River Irrigation Area (ORIA), Kununurra, Western Australia	2	Production	Nutrition	Assessment	DAW-29A	Not known
Environmental Factors in Influencing the Growth and Yield Rambutans and Cupuacu	1	Production	Systems Disease	Management Diagnosis	DNT-10A	Medium
Evaluation of Date Production in Central Australia	1	Production	Breeding	Evaluation	DNT-11A	Not known
Boosting of Durian Productivity	2	Production	Breeding	Reproduction/ establishment Propogation	DNT-13A	Medium/High
Productivity Responses of Asparagus to Droughting in a Tropical Environment	2	Production	Nutrition	Assessment	DNT-17A	Medium
Integrated Management of Phytophthora Diseases of Durian	2	Production	Disease	Management	DNT-24A	Too early
Nutrition and Irrigation Management of Rambutan for Maximisation of Yield and Quality — Northern Territory	2	Production	Nutrition	Irrigation Fertilizer	DNT-26A	Too early
Evaluation of the Potential of Growing Tuber Melanosporum as a Crop on Mainland Australia for Export and Domestic Consumption.	1	Production	Systems	Viability	DPS-1A	Low/Medium
The Impact and Control of Lychee Pepper Spot in Australia	2	Production	Pest/weed	Assessment Fungicide	DRW-1A	Too early
Strategic Planning — Longan Industry	2	Industry training and development	Development	Industry planning	LGA-1A	High
Cashew Program Review and Workshop — Kuranda 1996	1	Industry training and development	Development	R&D Planning	MS967-09	Not known
The Establishment of Economics Injury Levels and Control Methods for the Key Cashew Insect Pests	2	Production	Pest/weed	Assessment	NAB-4A	Not known
The Establishment and Production of the French Black Truffle Tuber Melanosporum in Tasmania	2	Production	Systems	Viability	PTT-1A	Medium/High

(Extension) The Establishment and Production of the French Black Truffle Tuber Melanosporum in Tasmania	2	Production	Systems	Viability	PTT-2A	Medium/High
Strategic Plans for the Australian Rambutan and Mangosteen Industries	1	Industry training and development	Development	R&D Planning	RTE-1A	High
An Evaluation of Australian Hazelnut Varieties with Respect to Physical and Nutritional Characteristics and Storage Potential	1	Industry training and development	Breeding	Evaluation	ULA-11A	Medium
A Study of Sweet Potato Viruses in Northern Territory Sweet Potato Crops	2	Production	Disease	Diagnosis	UNT-2A	Medium
The Effect of Native Vegetation on the Cashew Arthropod Fauna with Particular Reference to the Most Important Pest — Helopeltis	2	Production	Pest/weed	Biological control	UNT-3A	Not known
Utilisation of the Green Ant, Oecephylla Smaragdina, to Control Cashew Insect Pests	2	Production	Pest/weed	Biological control	UNT-4A	Not known
Continuation of Transplanted Green Ant Colony Monitoring and Implementation of the Ant Technology in Commercial Cashew Plantations	2	Production	Pest/weed	Biological control	UNT-5A	Not known
Developing the Non-astringent Persimmon Industry as an Export Industry for Australia — Final Stage	2	Production Processing Markets	Systems Complex Research	Management Evaluation Opportunities	UQ-21A	High
The Role of Parasites and Predators in Cashew Pest Control: Development of an Integrated Pest Management Programme	2	Production	Pest/weed	IPM	UQ-24A	Not known
A Field Evaluation of the Productivity of Hazelnut Varieties	1	Production	Breeding	Evaluation	US-74A	Too early
A Field Evaluation of the Productivity of Hazelnut Varieties	1	Industry training and development	Breeding	Evaluation	USO-1A	Medium
Specialty Mushroom Production Systems: Maitake and Morels	1	Production	Systems	Management	UT-30A	Too early
The Postharvest Browning of Rambutans Grown in the Northern Territory	2	Processing	Post harvest	Shelf-life	UWS-2A	Medium
Market Prospects and Research Priorities for Commercially Under-exploited Tropical Fruits, Vegetables and Nuts	1	Industry training and development	Development	R&D Planning	WS967-19	High
Durian Germplasm Evaluation for Tropical Australia Phase 1	1	Production	Breeding	Evaluation	ZTR-1A	Too early

Source: RIRDC database and files.

Fruit

Custard Apple — two projects on markets have been undertaken, both on market issues.

- DAQ-131A *Custard Apple Quality Production* sought to improve quality. Fruit quality was identified as a major limiting factor to market expansion; with there being a lack of knowledge on appropriate handling techniques. New varieties were evaluated and were/are undergoing further field trials. Nutritional aspects were improved, and handling aspects were improved significantly, for example, pre-cooling fruit to lower temperatures than was previously recommended. The NPP Review found that the QA scheme had led to higher prices. The output would therefore be high and it also led onto DAQ-167A.
- DAQ-167A *Removing Pre and Post Harvest Constraints to Custard Apple Marketing* was a follow-on project of DAQ-131A. The project is thought to have been successful.

Dates — One project has been undertaken in breeding. DNT-11A *Evaluation of Date Production in Central Australia* evaluated several cultivars used overseas and identified factors limiting productivity.

Durian — Prospects for this industry look bright, and it is predicted that the industry will grow from the current farm gate value of $0.3 million to $8 million by 2010 (Hyde 1997). Three projects have been undertaken in production. The first two focus on breeding, the last on disease.

- ZTR-1A *Durian Germplasm Evaluation for Tropical Australia Phase 1* aims to evaluate durian clonal introductions from Malaysia, Thailand and Indonesia. It also reviewed the Industry Strategic plan. The implementation/work program ensures continued momentum by all stakeholders to compete the priorities identified in the industry plan. The project is still in progress, so it is too early to say what sort of impact it is having, but it is going well.
- DNT-13A *Boosting Durian Productivity* focuses on problems in production. Durian has been identified as a crop with a lot of potential, but impediments do exist such as lack of high yielding adaptable cultivars, erroneous identification of cultivars, a long juvenile period, etc. The aim of this project was to overcome these impediments through: the introduction of better clones, increased understanding of phenology and reproductive biology, developing cultural measures, and fertilisation. The NPP Review found that there was a satisfactory impact on end-users, with the spin off being that it brought together durian growers. It has also been an input into the development of an industry strategic plan. It has been judged as a good basic building block to the industry and would have had a medium/high payoff.
- DNT-24A *Integrated Management of Phytophthora Diseases of Durian* is still in progress so it is too early to say what sort of impact it may have. Durian is an expensive crop to establish and this fungus can wipe out plantations. The fungus attacks the roots and this project is looking at what the best way of dealing with the problem, for example, mulch, pesticide, etc.

Longan — It is projected that the longan industry will grow from a farm gate value of $2 million to $14 million by 2010 (Hyde 1997). Five projects have been undertaken to assist the industry; two are joint with lychee and longan.

- Industry development — LGA-1A *Strategic Planning — Longan Industry* There is a recognised need for more research into longans, so a research levy has been proposed. The project developed a strategic plan required if a levy is to be introduced. This strategic plan was developed and can now be used by funding organisations in deciding upon research. However, the strategic plan has not always been recognised and accepted by funding bodies reducing the value of the plan. There is no doubt that growers have found the Plan useful background information to their management decisions as it is often quotes and used in research proposals. The project has a high outcome.
- Production — DAQ-251A and DAQ-177A are discussed under Lychees.
- Post-harvest — DAQ-249A *Developing a Post-harvest Handling and Storage Strategy for Longan* is too early to evaluate. Like many fruit and vegetables, Australia has a off-season advantage in longans, but this is reduced due to the spoilage that occurs during storage and handling of the fruit. There is a small amount exported at the moment, but there will be a large increase in production in the next few years because of the number of trees that have been planted. This project is looking at controlling post-harvest diseases, moisture losses, and changing appearance through techniques using things like refrigeration and fungicide.
- Markets — DAQ-260A *Market Opportunity Identification and Analysis of the Australian Domestic Market for Australian Longans and Rambutans* followed the recognition in LGA-1A that there was no market plan in the industry, so this project sought to develop one. Very early to say if it has definitely had an impact, but this is a crucial exercise in the development of any industry, so the impact should be high.

Lychee — The lychee industry currently has a farm gate value of $15 million, and is predicted to grow to $25 million by 2010 (Hyde 1997). Eight projects have been undertaken.

- Industry development — ALG-1A *Business and Strategic Plan for the Lychee Industry* sought to develop a business R&D plan for this crop. This crop has a great deal of potential. These are crucial documents so the effect would be high.
- Production — CSH-40A *Regulation of Cropping in Lychee* focuses on improving reliability of production. The opportunities for export of Lychee are increasing with the liberalising of markets in Asia. However, production is unreliable and cannot meet present demand due to trees failing to flower or set and retain a crop. Further work needs to be done, although some progress was made. The NPP Review suggested that there was a high level of communication with Lychee growers. This was a major stepping stone to further research. It suggested that the temperatures that the buds were exposed to were an important determinant of flowering. The follow-on project, DAQ-177A carried on the further research that was necessary. DAQ-177A *Improved Canopy Management to Maximise Market Opportunities for the Tree Crops Lychee, Longan and Rambutan* is the successor project to CSH-40A. It further investigated the effects of climate and was able to develop a model that predicted the best times for pruning up and down the coast. The project also determined that smaller trees can produce the same yield. This is important because the largest cost of producing lychee is picking, and smaller trees simplify this task dramatically. Also, smaller trees means netting to protect from bats and birds becomes an easier and cheaper task. The findings are starting to be picked up by industry, and there are plans for an extension project so that all of the industry adopts the findings. The impact should be high.
- Pest/weed — DRW-1A *The Impact and Control of Lychee Pepper Spot in Australia* was undertaken in response to a problem. Pepper spot has been identified as a problem that has the potential to cause significant losses to the industry. This project was a survey to see just how serious it is and if spraying was effective. It is too early to say what the impact might be.
- Post-harvest — DAQ-129A *Lychee Post-harvest Handling and Marketing* was stimulated by the fact that post-harvest handling and quality problems are inhibiting industry growth. Of all the new tropical fruits, it is felt that lychee has the potential to develop into a stable profitable industry. However, at the time of the project, there was a problem that the trees planted will reach maturity by the end of the decade, resulting in a glut in the market unless this problem is solved. This project aimed to develop a post-harvest handling and marketing system and a quality assurance system. An improved post-harvest handling system was developed and adopted, underpinned by the QA system. The marketing has also been greatly enhanced. Prices have increased despite an increase in production. A couple of more year's data was still needed to achieve a reasonable level of confidence though. The NPP Review judged that impacts have been high, with excellent technology transfer and communication. There were still some issues that needed to be addressed, specifically quality control in the field. This was the purpose of the follow-on project, CSP-7A. CSP-7A *Improved Post-harvest Handling of Lychee*, which is broader and more fundamental than the previous project, looking at quality control in the field. The aim of this project is to develop practices in the field to preserve the intrinsic quality of the fruit. Too early to tell what the impact of this project would be.

In addition to the above lychee projects several others were identified because they were mentioned in the NPP Review. They are not reported on the RIRDC database and are not included in the tables or chart.

- DAQ-81A *Pest Management in Lychee* established a basis for pest management in lychee and developed an Integrated Pest Management system. It determined the at least five species of bugs (some previously unsuspected) may cause significant green fruit drop. The impact should be significant to end users in both scientific and practical terms. It is evaluated to have medium impact.

- CSH-18A *Control of Fruit Set and Retention in Lychee* objective was to understand the environmental and genetic constraints on fruit set and retention in lychee to improve production levels. The findings were useful in sorting out possible limitations to lychee cropping based on high quality science. More work is required in new project (CSH-40A) to understand flowering failure. The impact on end users is probably marginal, although irrigation recommendations were revised. There are no cinturing recommendations at this stage. This project was judged as having a medium impact.
- DAQ-38A *The Control of Sex Ratio of Lychee* was also listed. Little is known about this project.
- DAN-54A *Overcoming Problems Related to Poor Root Health in Custard Apple and Lychee* was also listed. Little is known about this project.

Persimmon — One project has been undertaken on persimmons. UQ-*21A Developing the Non-astringent Persimmon Industry as an Export Industry for Australia-Final Stage* followed on from two projects QAC-4 *National Non-astringent Persimmon Industry Workshop* and QAC-2A *Developing a Non-astringent Persimmon Export Industry* about which little is known. These projects are not included in table 3.13 as they are not on the RIRDC database and were only identified at the end of this exercise. Persimmon has considerable potential and during UQ-21A, significant market development took place in Singapore, Malaysia and Hong Kong. This project was to co-ordinate R&D on the major unknowns in this industry in the areas of production, marketing and processing. Significant achievements were made in these areas. Almost all the research has proven commercially useful and has had a dramatic effect on the direction and pace of development of Australia's non-astringent persimmon industry. The NPP Review found that there was excellent liaison and communication of results by various means. A single brand export company to Singapore has been formed with over half of growers and many recommendations have been adopted as standard practice. It would be judged to have had a high impact and would be suitable for further evaluation.

Rambutan — It is predicted that the rambutan industry will grow from a farm gate value of $3 million to $12 million by 2010 (Hyde 1997). Five projects have been conducted on rambutan.

- Industry development — RTE-1A *Strategic Plans for the Australian Rambutan and Mangosteen Industries* developed strategic plans. Like the other strategic plans that have been developed, this project was very useful and has given the industry a view of the future and what its research priorities are. It has therefore had a high impact.
- Nutrition — DNT-26A *Nutrition and Irrigation Management of Rambutan for Maximisation of Yield and Quality — Northern Territory* is in its infancy. It is already proving to be of value to the farmer. There has been good grower involvement, which has meant that the initial data has caused changes in farmers' attitudes and management practices. DAQ-251A *Enhancing Fruit Yield and Quality of Rambutan and Longan by Optimising Irrigation and Nutritional Management Systems* is a related project. This project is on target and grower cooperator feedback is positive. It is looking at water and fertiliser required for good quality and quantity of fruit. It is too early to assess the impact it might have.
- Production systems — DNT-10A *Environmental Factors in Influencing the Growth and Yield Rambutans and Cupuacu* was an early investigation into things such as canopy management for these two crops. The work was an important stepping stone, providing information and experience for use in DAQ-177A, which is a large project looking at canopy management for lychee, longan and rambutan. The work on cupuacu could have benefits in cocoa R&D. Cupuacu is closely related to cocoa, and with the use of gene technology, beneficial traits of cupuacu could be transferred. This projects impact is judged to be medium.
- Processing — UWS-2A *The Post-harvest Browning of Rambutans Grown in the Northern Territory* aimed to extend the post-harvest storage life of rambutans. Rambutans are gaining importance, but are is limited by the susceptibility of the skin to desiccate and turn brown. The NPP

Review found that the project had not appeared to have led to any new developments in extending post-harvest life. Nevertheless, the project has had a medium impact, contributing to a better understanding of the damage that occurs.

Tropical Fruits — there are a number of projects that have been more general.

- DAQ-117A *The Potential for Mixed Transport of Selected Tropical Fruit* looked at transport issues. Due to the increasing production of new exotic fruit and the expensive airfreights, some producers are now transporting mixed loads. However, this may cause some problems, for example bananas, avocados and mangoes can induce tropical fruits like lychee to ripen quickly. This project suggested that such co-shipment is possible under a range of conditions. The NPP Review found that a simple computer package had been developed, but its uptake was unknown. However, useful information was produced and so it has been judged to have had a medium impact.
- AMR-4A Consultancy: *Market Study for Tropical Fruits, Vegetables and Nuts* was intended to look at overseas markets and to investigate the views of domestic importers and exporters on the potential of new industries. It produced a book that is highly sought after and was used in WS967-19, so the project had a high impact.
- WS967-19 *Market Prospects and Research Priorities for Commercially Under-exploited Tropical Fruits, Vegetables and Nuts* was a workshop. This workshop and AMR-4A were commissioned to investigate the potential of under-exploited tropical fruits that were in the early stages of commercialisation. The workshop concluded that there were five products, lychee, longan, rambutan, mangosteen and durian, that had good prospects. AMR-4A was used in this workshop to make these judgements, and these conclusions formed the basis for subsequent investment in these fruits. For example, the five year plans that were developed were suggested at this workshop. Therefor it has had a high impact.
- DAQ-140A *Germplasm Conservation of Minor Tropical Field Crops* was designed to collect and record germplasm for some tropical field crops to add to a database. It is not known what the impact of this project has been.
- DAQ-116A *Control of Production Patterns in Tropical Fruit* is a response to the rather narrow production window of tropical tree fruit crops. This work looks at understanding the natural variation (with cultivar, climate and cultural variation) that exists which needs to be done before investigating methods for manipulating production. This project allowed growers to identify cultivars that will extend their production period. In the longer term it will allow researchers working on these crops to understand the effect of pruning, etc. on growth patterns. The NPP Review said that this project was likely to be useful in cultivar selection and spreading maturity times for North Queensland. However, further work has been undertaken on this subject, which suggests that this project didn't answer all of the questions. It did contribute to the stock of knowledge and so has had a medium impact.

Vegetables

Asparagus — Two projects in production have been undertaken.

- DAQ-138A *Tissue Culture Development of a Tropical Asparagus Super-clone* was done in partnership with HRDC and is assessed as having a low impact. Asparagus in the tropics suffers from heat stress and cold-induced dormancy. It was hoped that a super-clone would be able to be bred from superior individuals to ease this constraint. However, it only resulted in a 3.9 per cent increase in yield, where it is estimated that a 30 per cent increase in yield is necessary.
- DNT-17A *Productivity Responses of Asparagus to Droughting in a Tropical Environment* report has just been submitted and it is judged to have a medium impact. In Victoria, the winter cold is needed in the growth cycle of asparagus. This project intended to determine if the winter dryness in

the Northern Territory could perform the same function. The findings have been promising and there is potential for trials to be undertaken.

Lima beans and sugar snap peas — DAQ-109A *Commercial Evaluation of Lima Beans and Sugar Snap Peas* was to assess the commercial opportunities for Lima beans and sugar snap peas in Queensland using the best overseas genetic and production/harvesting principles. It was determined that Australia could establish a Lima bean industry in South Queensland comparable to California's, however, market development would need to occur. Commercialisation of the sugar snap pea is unlikely because they lack climatic adaptability.

Sub-Antarctic species — People have been eating sub-Antarctic species since the 18th century. ANC-2A *New Salad and Vegetable Crops from Sub-Antarctic Islands* looks at prospects for acclimatisation, mass production, consumer reaction to these new products and nutritional value. Three species were looked at but more work is required and it is too early to say what the impact is.

Sweet potato — Sweet potato is a new crop and as such it needs to be ensured that viruses are not transferred through selected cultivars that are propagated from vine cuttings. It is also important to test cultivars for resistance. UNT-2A *A Study of Sweet Potato Viruses in Northern Territory Sweet Potato Crops* developed an assay procedure for a particular virus in sweet potato and will be used as a model for detection of other viruses in sweet potato. It has provided useful information and so has had a medium impact.

Mushrooms

- Black morel — UT-12A *Preliminary Investigation on 'French' Black Morel Cropping (Morchella angusticeps)* was a pilot study looking at other world markets and key factors influencing initiation. It was useful in that it was a good step to enable and encourage further research. This project is judged to have a high impact.
- Production — DAT-30A *The Development of Commercially Viable Culturing and Fruiting Systems for some Asian Specialty Mushrooms* was a joint project with the Asian Food Program. This project determined that it was possible to grow specialty mushrooms in 'captivity'. This has the potential to be lucrative because of the high prices that these mushrooms sell for. It set the foundations for UT-30A. UT-30A *Specialty Mushroom Production Systems: Maitake and Morels* is current and is funded in partnership with Asian Foods. This project is looking at production systems, producing such things as a technical bulletin and a feasibility study. It is moving onto assessment, but it is too early to determine what the impact is.
- Post-harvest — DAV-123A *Improved Post-harvest Handling and Storage of Specialty Mushrooms* was a survey that looked at the methods that were used in handling and storing mushrooms. It was able to suggest protocols that would keep mushrooms better than they are at the moment, so was very useful and had a high impact.

Truffles — There is potential for 'out of season' exports to Europe of truffles. Three projects have looked at truffles.

- PTT-1A and PTT-2A *The Establishment and Production of the French Black Truffle in Tasmania* attempted to establish the feasibility of growing truffles in Tasmania, understanding the markets for truffles, and establishing technical and commercial linkages. It was determined that truffles could be successfully grown in Tasmania and good commercial and technical linkages were formed. A reciprocal marketing arrangement has been organised with France because of the seasonal differences between the two countries. It has lead to feasibility studies in other states, and there has also been some investment in New South Wales and Western Australia. It has been judged to have had a medium/high impact.

- DPS-1A *Evaluation of the Potential of Growing Tuber Melansporum as a Crop on Mainland Australia for Export and Domestic Consumption* looks at practical issues related to the growing of truffles and the economic issues with respect to the costs of establishing an industry. It concluded that the establishment of a Perigold black truffle industry is possible in Australia, although some government support will be needed for the inoculation stage. The publication from this report is handed out fairly frequently, but overall it has had a low/medium impact.

Nuts

Cashews — The world cashew market is expanding and there is potential for plantations in northern Australia, although cashew need to have a yield that is 4–8 times higher than the world average. Cashews were reviewed as a program area in emerging industries in 1997. They since have returned to the new industry program. The economics of the industry are not positive, with large increases in yields required for viability of the industry.

- MS967-09 *Cashew Program Review and Workshop* held in August 1996 (MS967-09) identified that there was a need to develop a manual of 'best practice' to guide decision making in the Australian cashew industry. It was an input into CSL-1A *Development of an Australian Cashew Industry Information Support System*, which aimed to provide an Information Support System to assist the establishment of an Australian cashew industry that is sustainable. It suggested that there are good prospects for the future of the Australian cashew industry and the manual developed in this project is expected to play a major role in encouraging new investors.
- CSH-41A *Cashew Fingerprinting Study*, not much is known about this project.
- CSH-36A *Genetic Improvement of Cashew through Hybridisation* aimed to improve yields through selective breeding. CSH-43A *Evaluation of Growth Habit, Yield and Nut Weight and Shelling Percentage of Cashew Hybrids Planted at Three Test Sites* continued on from CSH-36A. This project identified 49 high yielding hybrids were identified which is encouraging, and replicated trial are planned for the next phase of the program (CSH-48A). CSH-48A *Evaluation of Growth Habit, Flowering Behaviour and Yield of Cashew Hybrids and Layout Replicated Trials with some High Yielding Hybrid Selections* is the third phase of RIRDC project CSH-43A.
- CSP-6A *Evaluation of Growth Habit, Flowering Behaviour and Yield of Cashew Hybrids and Layout of Progeny Trials with some High Yielding Hybrid Selections (Final Phase of Breeding Project)*
- BRI-1A *Securing and Maintaining Cashew Germplasm at Howard Springs NT*
- DAQ-145A *Cashew Nutrition Management Strategies*
- DAQ-257A *Cashew Nutrition Management Strategies 2*
- CSO-11A *Field Validation of 'Best Bet' Fertiliser Management Strategies for Cashews in North Queensland* aimed to verify suggestions by recent research that current yields from cashews could be increased by improved fertiliser strategies and so allow current growers and potential investors to undertake expansion and consolidation. It was shown that fertiliser improved yield by about 50 per cent and profitability by about $400 per hectare per year. However, a low nutritional status has been identified as a problem, so more research needs to be done on this.
- DAW-29A *Nutrition Studies of Cashew on Cunurra Clay at the Ord River Irrigation Area* was a trial crop. Soil in Cunurra is low in certain minerals needed for cashews, so this study looked at the fertiliser requirements and leaf and tissue sampling techniques. The trial was terminated when the trees were very young, so the results, which showed marginal responses, are preliminary. The leaf analysis techniques were successful and so can be used as a diagnostic tool in managing nutrition.
- Since their establishment, cashew plantations in Australia have suffered from insect pests, particularly Helopeitis. This pest was investigated and the green ant was determined to be the most

important biological control agent, paving the way for more research. Three projects — UNT-3A *The Effect of Native Vegetation on the Cashew Arthropod Fauna with Particular Reference to the Most Important Pest- Helopeitis* UNT-4A *Utilisation of the Green Ant to Control Cashew Insect Pests* and UNT-5A *Continuation of Transplanted Green Ant Colony Monitoring and Implementation of the Ant Technology in Commercial Cashew Plantations* — have studied this biological solution with some success. Other projects in this area are NAB-4A *The Establishment of Economic Injury Levels and Control Methods for Key Cashew Insect Pests* and UQ-24A *The role of Parasites and Predators in Cashew Pest Control: Development of an Integrated Pest Management Programme.*

Chestnuts — DAV-81A *Improved Quality and Marketability of Chestnuts by the Control of Phompsis Nut Rot and the Extension of Storage Life* was conducted after a direct approach from the industry. Nut rot can cause up to 90 per cent of losses. The project looked at various practices such as frequency of harvest, and pre-storage water soaking. However, some further studies are required before commercial use, but the impact would be medium.

Hazelnuts — Three projects on breeding and evaluation have been undertaken.

- USO-1A *A Field Evaluation of the Productivity of Hazelnut Varieties* was prompted by the fact that many varieties of hazelnuts have been imported into Australia over the last few decades, but there has been no evaluation of these. This project was designed to determine the most productive hazelnut varieties and to assess the effects of geographical region on hazelnut production and varietal performance. Marketing work was also done. The tree had only just come into production at the end of the project and trials needed to be conducted for another four years. There were promising results that have lead to an increase in the length of scope of RIRDC's R&D funding, so the impact could be medium.
- US-74A *A Field Evaluation of the Productivity of Hazelnut Varieties* continues USO-1A, but trials and evaluations have now been expanded to Tasmania.
- ULA-11A *An Evaluation of Australian Hazelnut Varieties with Respect to Physical and Nutritional Characteristics and Storage Potential* is assessed as having a medium impact, with some useful knowledge being generated. Much of the work centred on the physical characteristics of hazelnuts.

Pistachio — CSH-37A *Ensuring the Long Term Future of the Pistachio Industry by Development of Procedures to Overcome Problems Associated with Dormancy and Disease* — little is known about this project.

Walnuts — Two projects looked at production issues, one extending that to industry best practice.

- Production — DAV-73A *High Yields and Early Bearing for Walnuts and Quality Timber* aimed at establishing a system of soil and plant management to overcome the fact that soils are generally unsuitable for walnut production in Australia. It relied on trying to imitate practices used for stone fruits and adapting them to suit walnuts. Good growth rates were achieved and the project has had a high impact.
- Industry development — DAV-164A *Walnut Industry Research and Best Practice Implementation* is the follow-up to DAV-73A and is still in progress. It is looking at quality management, developing agronomic packages and a fee-for-service advisory arm. It is too early to evaluate the impact it has had.
- AWI-1A *Development of Quality Management Systems for the Australian Walnut Industry* is still in progress. It is developing a handbook for quality management from the field to harvest. At this stage the expect impact of it is medium/high.

Prospective grain and pulse crops

Projects

RIRDC supports work on the non-levied grains and also some crops often wrongly identified as grains such as buckwheat. When products in this area graduate they are handled by GRDC, such as in the case of sorghum and some pulses. Buckwheat is a growing industry with good market prospects in Japan. Australian production has an export value of around $1.5 million. (Evans, January 2000)

New pulses are investigated by RIRDC. When plantings reach a certain size research obligations are usually undertaken by GRDC.

There have been 27 projects undertaken under this area of the program. The total cost of these projects is $5.5 million of which 32 per cent has been funded by RIRDC. The projects are listed in table 3.16.

Classification

The projects are distributed across the various categories. The classification is illustrated in chart 3.16, which shows the links between projects, and summarised in table 3.17.

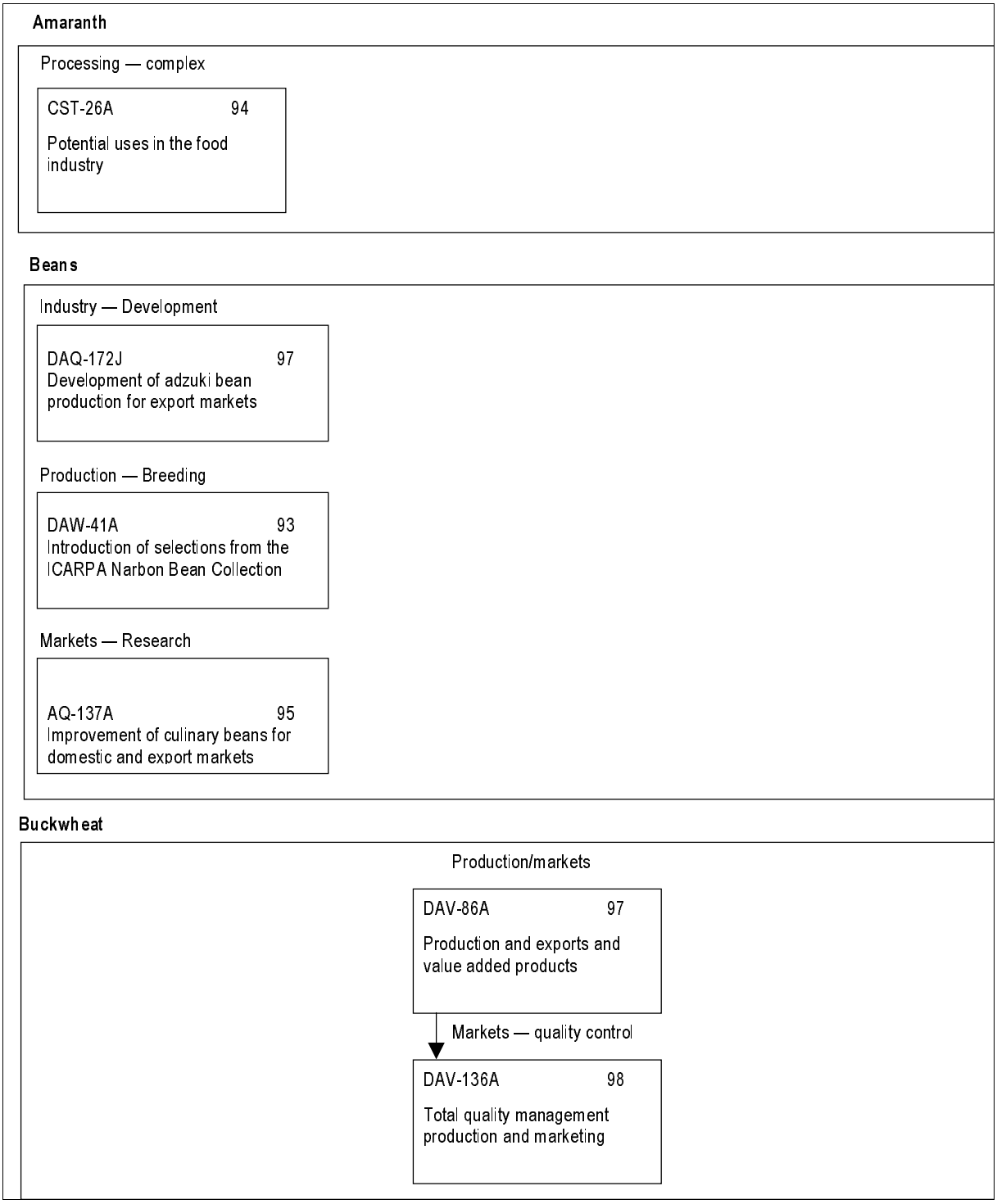
3.16 **Projects — timing and funding Prospective grain and pulse crops**

Project	*Code*	*Start date*	*Finish date*	*RIRDC total*	*Industry total*	*Research organisation total*	*Total*
Evaluation of the Agronomic Market Opportunities for T'ef	AGS-1A	—	—	32 000	0	0	32 000
Developing a Technological Package to Select for Enhanced Levels of Osmotic Adjustment to Improve the Yield of Dryland Grain	CSC-46A	—	30/06/93	44 207	44 207	0	88 414
Developing Molecular Markers for Osmotic Adjustment in Maize and Sorghum	CSC-48A	—	30/09/96	124 839	0	242 218	367 057
Potential Uses of Grain Amaranth in the Australian Food Industry: Food and Nutritional Aspects	CST-26A	—	30/06/94	1 000	0	0	1 000
The Efficiency and Residual Value of Applying Nitrogenous Fertilisers to Sorghum Crops in Conservation Cropping Systems	DAQ-119A	—	10/06/96	14 507	7 550	38 718	60775
Development of a Rapid Test to Determine the Level of Midge Resistance in Sorgum Hybrids	DAQ-120A	—	30/06/92	6 500	—	—	6 500
Quantifying and Predicting the Effects of Water Stress on Grain Number, Grain Size and Grain Yield of Sorghum	DAQ-121A	—	30/06/92	20 000	20 000	123 970	163 970
A Field Evaluation of Egg Parasitoids for Heliothis Managment in Sorghum	DAQ-130A	—	30/06/94	29 000	0	58 500	87 500
Grain Sorghum Quality — Heavy Metal Status	DAQ-134A	—	30/06/94	23 750	—	50 948	74 698
Analysis of Differential Performance of Sorghum Hybrids over Diverse Environments	DAQ-135A	—	30/06/93	5 000	5 000	147 700	157 700
Maize and Sorghum Germplasm Conservation	DAQ-136A	—	30/06/95	21 380	13 550	383 130	418 060
Improvement of Culinary Beans for Domestic and Export Markets	DAQ-137A	—	30/06/95	142 900	76 500	590 910	810 310
Workshop for Phaseolus and Other Potential New Summer Grain Legumes	DAQ-155A	—	1/01/94	9 250	—	8 750	18 000
Development of Adzuki Bean Production for Export Markets (Managed by HRDC)	DAQ-172J	—	30/06/97	142 500	0	0	142 500
Lentil Improvement and Development for Southern Australia through Selection and Breeding	DAS-34A	—	30/06/97	173 602	53 837	62 096	289 535
Development of Premium Quality Lentils Adapted to Australian Environments and Technology	DAS-9A	—	1/06/91	36 341	—	—	36 341
Total Quality Management for the Production and Marketing of Buckwheat and Honeybee Pollination of Buckwheat	DAV-136A	1/07/97	18/12/98	197 906	89 000	225 271	512 177
Production and Export of Buckwheat Grain and Value Added Products	DAV-86A	—	30/06/97	151 336	94 248	165 705	411 289
Introduction of Selections from the ICARDA Narbon Bean Collection	DAW-41A	1/07/92	30/06/93	6 000	—	6 215	12 215
Genetic Improvement of Sesame for Northern Australia	DNT-14A	1/07/93	14/11/97	83 852	0	223 252	307 104
Weed Control in Sesame	DNT-15A	1/07/93	1/07/96	69 257	0	219 911	289 168
First Australian Sesame Workshop	DNT-18A	1/07/94	30/06/95	17 750	—	43 750	61 500
Final Development of Sesame Cultivars for Australia	DNT-6A	1/07/90	30/06/93	43 435	25 685	304 750	373 870
A Comparative Study of Australian and United States Isolates of Wheat Flag Smut	GPW-1A	1/01/91	30/06/92	39 988	39 988	0	79 976

Australian Grain Sorghum Industry Workshop	PIN-1A	27/08/91	29/08/91	11 000	11 000	11 000	33 000
National Oat Rust Control	US-1A	—	pre-1994	9 000	21 493	—	30 493
Development of Lathyrus Species as New Grain Legumes	UWA-21A	1/07/93	30/08/98	301 520	78 918	238 743	619 181

Source: RIRDC database and files.

3.17 **Projects — classification and initial assessment Prospective grain and pulse crops**



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3.17 **Projects — classification and initial assessment Prospective grain and pulse crops**
(Continued)

Legumes

Production — breeding

UWA-21A 98
Development of lathyrus species as new grain legumes

Communication — industry

DAQ-I55A 94
Workshop for potential new summer grain legumes

Lentils

Production — breeding selection

DAS-9A 91
Development of premium quality lentils adapted to Australia

→

DAS-34A 97
Improvement and development for Southern Australia

Oats

Production — disease

GPW-IA 92
Comparative study of Wheat Flag Smut

US-IA 02
National oat rust control

Communication — industry

DAW-39A 93-94
Fourth International Oat Conference

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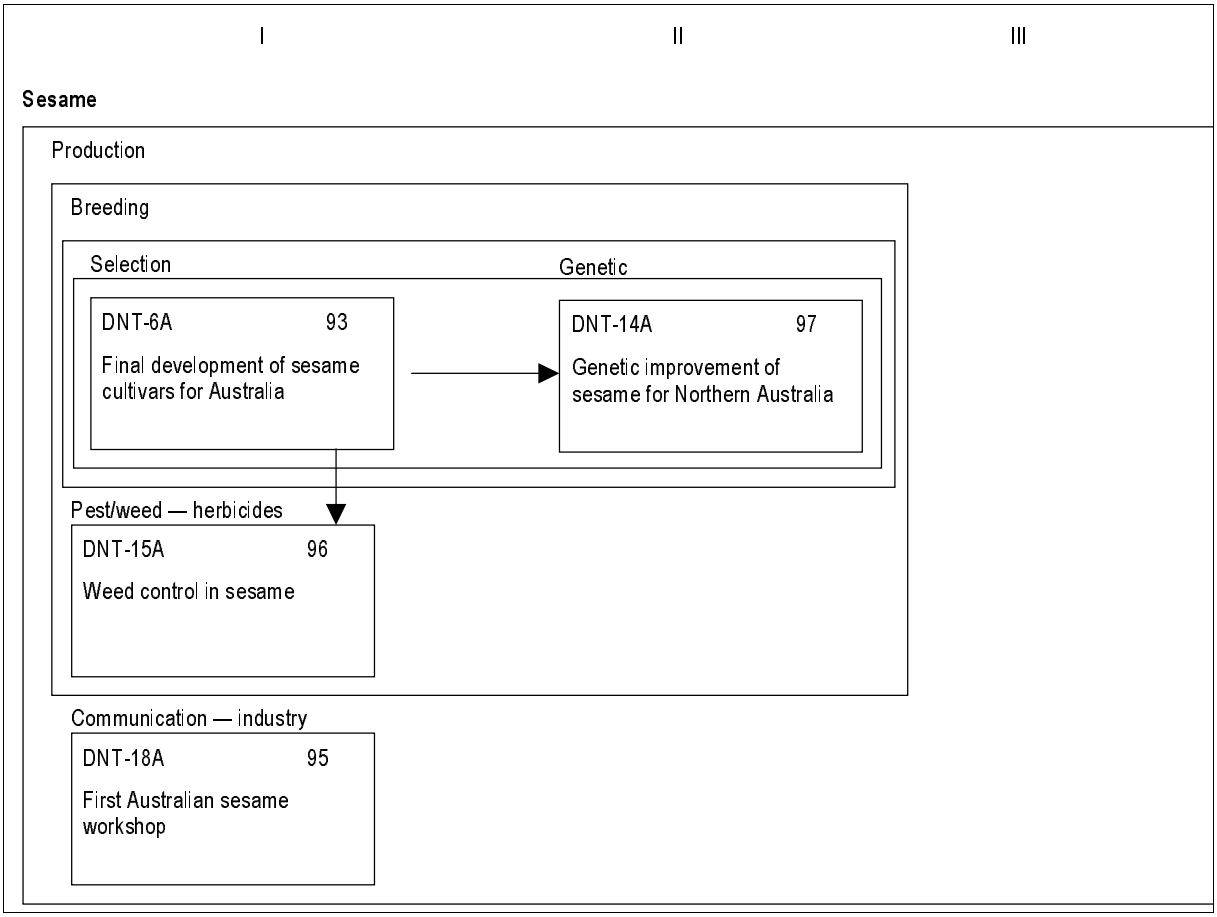
3.17 **Projects — classification and initial assessment Prospective grain and pulse crops**
(Continued)



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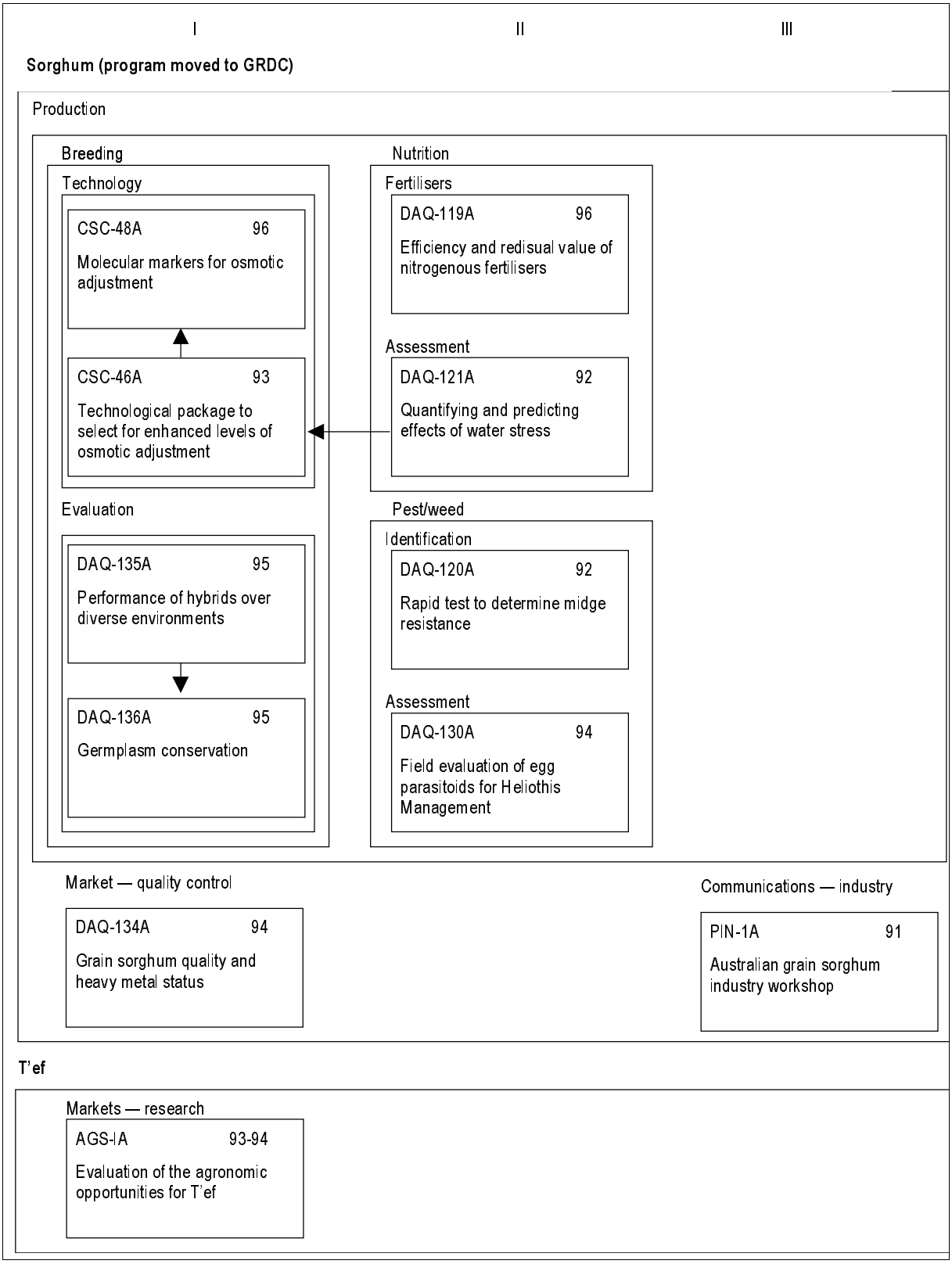
3.17 **Projects — classification and initial assessment Prospective grain and pulse crops**
(Continued)



Initial assessment

The initial assessment is based on the project manager's judgement of the outcome of the project. A summary of each project group, as set out in chart 3.17 is provided. Most of the projects have focused on a specific product or groups of products. Table 3.18 summarises the assessment.

3.18 Projects — classification and initial assessment Prospective grain and pulse crops

Project	*Stage*	*Level 1*	*Level 2*	*Level 3*	*Code*	*Evaluation*
Evaluation of the Agronomic Market Opportunities for T'ef	1	Markets	Market research	Opportunities	AGS-1A	Low/Medium
Developing a Technological Package to Select for Enhanced Levels of Osmotic Adjustment to Improve the Yield of Dryland Grain	1	Production	Breeding	Selection	CSC-46A	Not known
Developing Molecular Markers for Osmotic Adjustment in Maize and Sorghum	1	Production	Breeding	Technology	CSC-48A	Low/Medium
Potential Uses of Grain Amaranth in the Australian Food Industry: Food and Nutritional Aspects	1	Processing	Complex Processing	New properties	CST-26A	Medium
The Efficiency and Residual Value of Applying Nitrogenous Fertilisers to Sorghum Crops in Conservation Cropping Systems	2	Production	Nutrition	Fertilisers	DAQ-119A	Not known
Development of a Rapid Test to Determine the Level of Midge Resistance in Sorgum Hybrids	2	Production	Pest/weed	Identification	DAQ-120A	Not known
Quantifying and Predicting the Effects of Water Stress on Grain Number, Grain Size and Grain Yield of Sorghum	2	Production	Nutrition	Assessment	DAQ-121A	Not known
A Field Evaluation of Egg Parasitoids for Heliothis Managment in Sorghum	2	Production	Pest/weed	Assessment	DAQ-130A	Medium
Grain Sorghum Quality - Heavy Metal Status	1	Markets	Quality control	Food safety	DAQ-134A	Not known
Analysis of Differential Performance of Sorghum Hybrids over Diverse Environments	1	Production	Breeding	Evaluation	DAQ-135A	Not known
Maize and Sorghum Germplasm Conservation	1	Production	Breeding	Germplasm conservation	DAQ-136A	Not known
Improvement of Culinary Beans for Domestic and Export Markets	1	Markets	Market Research	Opportunities	DAQ-137A	Medium/High
Workshop for Phaseolus and Other Potential New Summer Grain Legumes	3	Communication/technology transfer	Industry	Seminars	DAQ-155A	Not known
Development of Adzuki Bean Production for Export Markets (Managed by HRDC)	1	Industry training and development	Development	Economic analysis	DAQ-172J	Medium/High
Lentil Improvement and Development for Southern Australia through Selection and Breeding	1	Production	Breeding	Selection	DAS-34A	High
Development of Premium Quality Lentils Adapted to Australian Environments and Technology	2	Production	Breeding	Selection	DAS-9A	Not known
Total Quality Management for the Production and Marketing of Buckwheat and Honeybee Pollination of Buckwheat	2	Production Markets	Systems Quality control	Management Quality Management	DAV-136A	High
Production and Export of Buckwheat Grain and Value Added Products	2	Production	Systems	Management	DAV-86A	High
Introduction of Selections from the ICARDA Narbon Bean Collection	1	Production	Breeding	Selection	DAW-41A	High
Genetic Improvement of Sesame for Northern Australia	2	Production	Breeding	Selection	DNT-14A	Not known
Weed Control in Sesame	1	Production	Pest/weed	Herbicides	DNT-15A	Not known
First Australian Sesame Workshop	1	Communication/technology transfer	Industry	Seminars	DNT-18A	Medium/High

Final Development of Sesame Cultivars for Australia	1	Production	Breeding	Selection	DNT-6A	Low/Medium
A Comparative Study of Australian and United States Isolates of Wheat Flag Smut	1	Production	Disease	Management	GPW-1A	Not known
Australian Grain Sorghum Industry Workshop	3	Communication/technology transfer	Industry	Seminars	PIN-1A	Not known
National Oat Rust Control	1	Production	Disease	Management	US-1A	Not known
Development of Lathyrus Species as New Grain Legumes	2	Production	Breeding	Evaluation	UWA-21A	High

Amaranth

CST-26A *Potential Uses of Grain Amaranth in the Australian Food Industry: Food and Nutritional Aspects* evaluated the nutritional value of the grain amaranth. The project concluded there is a niche market in the Australian food industry for this high protein food while providing some useful background and agronomy information. There is now one farmer in Victoria who is producing trial tonnage of amaranth for use in breakfast cereal. He is thought to be using some of the findings. This is assessed as having medium impact.

Beans

- DAQ-172J *Development of Adzuki Bean Production for Export Markets*, in partnership with the GRDC, aimed to assess the potential of Australia to develop an agriculturally competitive adzuki bean industry. The project succeeded in stimulating strong market interest by Japanese processors in establishing value added processing in Australia. These commercial contacts are continuing beyond project termination and prospects for investment vary from fair to good. However, the research momentum needs to be maintained to support the establishment of value adding in Australia. Evaluated at medium/high.
- DAW-41A *Introduction of Selections from the ICARDA Narbon Bean Collection* undertook the quarantine screening of 22 of the most promising lines of narbon bean which has been shown to have good potential in low rainfall areas. Only one line was released as the project was transferred to a different partner where a re-evaluation of priorities took place. This project succeeded in enabling further research to be taken over by the GRDC and CLIMA. The lines involved in this project have been used as parents for the stock of the industry. Judged to have a high impact.
- DAQ-137A *Improvement of Culinary Beans for Domestic and Export Markets* identified markets, germplasms and accessions. It is thought that culinary beans can be produced in much the same way as the established navy bean. Australian grown culinary beans were evaluated to be uncompetitive in the domestic market and only marginally competitive in the export market, of which Japan was identified as the most promising. The NPP report found this project to be satisfactory, with evidence that production of culinary beans had begun to try and fill a market niche. This was good linkages between the research team and industry.

In addition to these projects three other projects were identified as they had been reviewed in the NPP Review. They are not on the RIRDC database and have not been included in the tables or charts.

- DAN-14A *Development of the Adzuki Bean Industry in Australia* objectives were to: to investigate problems restricting production and expansion; solve problems with crop production and grain quality; and investigate weed control, varietal improvement and harvest management. The project identified a superior cultivar and increased the scope for the use of chemicals. However, without additional research the scientific outcomes will not generate practical results.
- DAQ-72A *Breeding for Improved Fixation in Navy Beans Using Ureide Assays* was designed to increase the level of N2 fixation though crossing and selection. The results of this research were marginal, indicating that there is a barrier in the present genetic material and that there will need to

be a change in research areas such as looking at interspecific crossing with maybe cowpeas. There appears to be very little benefit so far for end users in this research as there are too many imponderables to overcome. The science from this project has contributed to the knowledge on navy beans ability to fix N2. The impact is judged as medium.

- DAQ-55A *Integrated Control for Pests of Navy Beans* was also listed. Little is known about this project.
- **Pigeon Peas** — DAN-27A *Selection of Pigeon Pea with High Nitrogen Fixation Capacity and High Yield for Northern New South Wales and QLD* was also reviewed. The NPP review of this project suggests that it went unsatisfactorily. The objectives was to identify and select geneotypes/cultivars of pigeon peas with desirable characteristics and to develop an agronomic package. An agronomic package was not developed and there are very few places in Australia where soils are low in iron in environments where this crop will grow. There is no future for the crop so this research was of very little benefit, meaning a low impact.

Buckwheat

Buckwheat has good potential in Australia for export to Japan where it is used in noodles. This is because of the seasonal differences between Australia and other producers of the grain, for example Canada and Russia.

- DAV-86A *Production and Export of Buckwheat Grain and Value Added Products* developed agronomy packages and an integrated industry. It also showed that high quality and quantity buckwheat could be grown and increased industry awareness. This resulted in the construction of a Japanese noodle factory and restaurant and the commercial production of buckwheat, but further work was needed, for example on pollination. This was the purpose of DAV-136A.
- DAV-136A *Total Quality Management for the Production and Marketing of Buckwheat and Honeybee Pollination of Buckwheat* achieved the quality assurance and better understanding of pollination, identified in the previous project. Buckwheat is now an industry that is growing and the RIRDC projects that were funded for this grain would be good to evaluate further and would be expected to have a high impact. There is a proposal for a further three years of research, but already the industry is producing 2500 tonnes a year. More work needs to be done on quality, especially because the Japanese only accept high quality product. There will be a buckwheat industry review shortly.

These two projects are evaluated in stage 2 of this report.

Legumes

- DAQ-155A *Workshop for Phaseolus and Other Potential New Summer Grain Legumes* was undertaken as there was a need for the scanning of all aspects of new crop commercialisation, production, extension, crop research, economics, food processing, industry structure and marketing, which this workshop was designed to do. Two task forces and four special committees were established.
- UWA-21A *Development of Lathyrus Species as New Grain Legumes* developed two lathyrus species considered to have considered to have considerable potential for dryland farming systems in southern Australia. This project was designed to evaluate genotypes of these two species, eventually leading to the development of an agronomic package. Yield was shown to be equivalent to field peas in the appropriate environment. An agronomic package was produced. Adaptation of current material is sufficiently good to encourage the release of varieties; however, evaluation of other genotypes from overseas or recently locally developed ones is necessary to increase yields in short season environments. Local animal feed is the most likely first market, but proposed changes in

Indian regulations may soon allow importation for human consumption. There has been the commercial release of at least one line, and the resources devoted to the project have been relatively low. This is because it is an annual crop so delays and costs associated with establishment are relatively low.

Lentils

DAS-9A *Development of Premium Quality Lentils Adapted to Australian Environments and Technology* led into DAS-34A *Lentil Improvement and Development for Southern Australia through Selection and Breeding.* Southern Australia has a similar climate to Turkey, the world's largest lentil producing nation. Therefore, there seems to be quite a bit of potential for the production of lentils in Australia. This project evaluated 400 lines of lentils, and resulted in the selection of two for release. These two breeds have contributed to an enormous increase in the production of lentils in Australia, from 474 tonnes in 1991-92, to 38 350 tonnes and increasing in 1996–97. This project was evaluated as being satisfactory in the Review of NPP projects. The two projects are expected to have a high impact and are evaluated in stage 2 of this report.

Oats

- GPW-1A *A Comparative Study of Australian and United States Isolates of Wheat Flag Smut* looked at wheat smut. The United States does not allow any mixed wheat seeds in oat shipments from Australia as it may harbour strains of the wheat flag smut that might differ in virulence to those from the U.S. This study showed that there are minor differences, but this could be due to variation in the condition of the spores. The results suggest that isolates of Australian wheat flag smut do not pose a threat to the U.S. The final impact of the project is not known.
- US-1A *National Oat Rust Control* aimed to provide information and assistance to breeders to produce rust-resistant cultivars. The production of oats is severely constrained by the occurrence of stem and leaf rust fungi. Further investigation is needed to understand the genetics of resistance, however, due to this project breeders are now more aware of the need of including resistance in their breeding program. The final impact of the project is not known.

Sesame

Australia has a growing sesame industry. Four projects have been undertaken on sesame.

- DNT-18A *First Australian Sesame Workshop* was designed to address the need for coordination and information exchange. The suggestions made during the workshop provide an excellent basis for the development of a strategic plan, which is being developed.
- DNT-6A *Final Development of Sesame Cultivars for Australia* aimed to select other cultivars that were suitable for north Australia, while also working on identifying an appropriate herbicide for the industry as the current sesame commercial cultivars have some problems. While the findings were appropriate to develop a new industry there has been little impact on the end users. This is because the NT farmers targeted to grow this crop are not experienced at growing field crops and do not have the specialised equipment needed to seed and harvest this crop. Also, the new cultivar developed in this project has problems, related to seed loss. A new proposed project aims to deal with this. Work on herbicides will also be continued on in another projects. The Review of NPP Projects evaluated this project as satisfactory. The impact is assessed as low to medium.
- DNT-14A *Genetic Improvement of Sesame for Northern Australia* continued on from DNT-6A to try and avoid the problems with seed loss. The plants split and because of this, the seeds are lost in the process of harvesting. This project has attempted to overcome this through genetic improvement of the plant.

- DNT-15A *Weed Control in Sesame* deals with the weed control problems passed on from DNT-6A. The most suitable herbicides did not affect the broad-leaf weeds, but some progress has been made towards an integrated weed management system.

Sorghum

Little is known about the outcomes of the projects undertaken on sorghum as the program has been transferred to GRDC. The projects are listed here for the record.

- PIN-1A *Australian Grain Sorghum Industry Workshop*.
- DAQ-134A *Grain Sorghum Quality-Heavy Metal Status* was a response to health concerns. Due to the increased awareness of heavy metals in plant tissue, this project looked at the levels in sorghum and possible sources of contaminants. The levels found were low, assisting the industry in the promotion of the product.
- DAQ-135A *Analysis of Differential Performance of Sorghum Hybrids over Diverse Environments*. The project objectives were to compile the sorghum adaptation data to a permanent database; to complete the analysis of sorghum in different environments; and to attend a conference in Iowa.
- CSC-46A *Developing a Technological Package to Select for Enhanced Levels of Osmotic Adjustment to Improve the Yield of Dryland Grain* was aimed at developing a technique for screening sorghum for osmotic adjustment and to assess the benefit of it. Previous research had identified osmotic adjustment as a trait with potential to improve drought resistance and hence grain yield under water stress conditions. Two genes were identified as being significant and the results of current research (when the project finished) will determine the value of these genes to breeders.
- CSC-48A *Developing Molecular Markers for Osmotic Adjustment in Maize and Sorghum* continued on from the work from CSC-46A. There were problems in the first two years of the project, but a change of direction in the last 12 months paved the way for some very good work. The findings were inconclusive in the end however they did receive a lot of international attention. The NPP Review judged this project to be partially satisfactory. The impact would be low/medium.
- DAQ-136A *Maize and Sorghum Germplasm Conservation* aimed to address the problem that sorghum and Maize germplasm collections are poorly catalogued. This project has lead to the facilitation for the use of a wide genetic variety in breeding programs. This project was judged to be satisfactory in all areas in the 1997 NPP Review.
- DAQ-121A *Quantifying and Predicting the Effects of Water Stress of Grain Number, Grain Size and Grain Yield of Sorghum* was designed to develop a test and incorporate results into computer models of the effects of water stress on grain number, grain size and grain yield of sorghum.
- DAQ-119A *The Efficacy and Residual Value of Applying Nitrogenous Fertilisers to Sorghum Crops in Conservative Cropping Systems* was to construct a budget for the optimal application of nitrogen.
- DAQ-130A *A Field Evaluation of Egg Parasitoids for Heliothis Management in Sorghum* investigated pesticide resistance is becoming a problem so this project looked at biological control of Heliothis. It concluded that biological control by itself would not be economically viable, but further investigation into its use with minimal application of insecticides probably warrants further investigation. This has been done under the pests and diseases program. This project was seen as satisfactory in all aspect in the NPP review and is judged to have had a medium impact.
- DAQ-120A *Development of a Rapid Test to Determine the Level of Midge resistance in Sorghum Hybrids*.

T'ef

T'ef is an Ethiopian food, and there is potential for a market for the ethnic population in Australia.

- AGS-1A *Evaluation of the Agronomic Market Opportunities for T'ef* undertook a market survey and field trials were conducted. There is potential for an export market and there is the possibility that t'ef could be a profitable summer crop. However, the market is small and could be flooded quickly if several producers grew the crop. This has been a vaguely useful project, and judged to have low/medium impact.

Miscellaneous

Projects

RIRDC supports work on the non-levied grains and also some crops often wrongly identified as grains such as buckwheat. When products in this area graduate they are handled by GRDC, such as in the case of sorghum and some pulses. Buckwheat is a growing industry with good market prospects in Japan. Australian production has an export value of around $1.5 million. (Evans, January 2000)

New pulses are investigated by RIRDC. When plantings reach a certain size research obligations are usually undertaken by GRDC.

There have been 23 projects undertaken under this area of the program, 12 on the new plant industry. The total cost of these projects is $5.1 million of which 31 per cent has been funded by RIRDC. The projects are listed in table 3.19.

Classification

The projects are distributed across the various categories. The classification is illustrated in chart 3.19, which shows the links between projects, and is summarised in table 3.20.

3.19 **Projects — timing and funding Miscellaneous**

Project	*Code*	*Start date*	*Finish date*	*RIRDC total*	*Industry total*	*Research organisation total*	*Total*
Assessment of Commercial Prospects and Research Priorities for New Industries: Methodological Review and Development	AGT-1A	—	1/04/94	45 900	0	7 000	52 900
Emerging Opportunities in Agriculture Conference	AST-1A	1/07/97	31/12/97	10 000	31 500	8 000	49 500
Duckweed - A Potential High Protein Source for Supplementation of Feeds for Domestic Animals and Fish	BWM-1A	—	1/05/98	70 000	0	112 680	182 680
Weeping Grass – Development of Techniques to Maximise Seed Harvesting	CCA-1A	—	30/04/93	29 150	0	29 150	58 300
Identification of Success Factors in the Development of New Agricultural Industries in Northern Australia	CSC-49A	—	30/06/92	65 310	0	36 180	101 490
Acacia Saligna as a Fodder Source for Ruminants	CUT-6A	28/07/99	30/01/02	49 980	6 000	45 726	101 706
Clonal Propagation and Genetic Improvement of Kentia Palms through Tissue Culture	DAQ-77A	—	31/12/92	75 433	0	0	75 433
Development of a Mustard Industry in North West Victoria	DAV-31A	—	30/06/93	175 651	991 747	237 930	1 405 328
Production of High Quality Seed from Atriplex SPP.	DAW-27A	1/07/90	30/06/93	97 792	0	63 428	161 220
First National New Rural Industries Conference, Perth 1998	DAW-90A	15/01/98	30/11/99	30 000	10 200	50 700	90 900
A Reference Manual on New and Emerging Rural Industries	HYD-1A	1/02/97	31/10/97	86 750	—	—	86 750
A Statistical Summary System for Reports on RIRDC Portfolio Industries	HYD-2A	1/02/97	30/06/97	6 740	—	—	6 740
Canary Seed Industry Development for Southeastern Australia	UM-42A	31/07/98	30/06/01	87 500	89 450	65 129	242 079
Commercialisation and Development of an Agronomic Package for Microlaena Stipoides for Forage and Other Purposes (Joint Agreement with MRC)	UNE-35A	1/07/93	30/06/96	115 291	234 816	109 021	459 128
New Crops: Development and Application of Improved Selection and Evaluation Procedures to Produce New Crops for Northern Australia	UQ-33A	1/07/93	30/09/99	458 883	61 420	975 209	1 495 512
First Australian New Crops Conference	UQ-44A	1/07/95	30/09/97	30 000	0	90 000	120 000
Australian New Crops Newsletter	UQ-80A	1/07/98	30/11/00	20 000	10 500	14 500	45 000
Preliminary Investigation on 'French' Black Morel Cropping (Morchella Angusticeps)	UT-12A	22/08/96	31/08/97	19 831	9 000	59 655	88 486
Leguminous Browse Species as Forage Plants for Temperate Environments	UT-25A	23/07/99	31/03/03	75 170	15 000	116 785	206 955
Desert Ephemeral Plants as Teaching Tools	UWS-6A	1/11/93	30/11/96	38 085	150	11 722	49 957

Source: RIRDC database and files.

3.20 **Project — classification and initial assessment Miscellaneous**

General

Communication — Industry

Seminars

AST-1A 97
Emerging opportunities in agriculture conference

UQ-44A 97
First Australian new crops conference

DAW-90A 99
First national new rural industries conference Perth 1998

Information systems

HYD-2A 97
A statistical summary system for reports on RIRDC portfolio industries

Publication

HYD-1A 97
A reference manual on new and emerging rural industries

Newsletter

UQ-80A 00
Australian new crops newsletter

(Continued on next page)

3.20 **Project — classification and initial assessment Miscellaneous** (Continued)

General

Industry — development

Benchmarks

UQ-33A 99

New crops: development and application of improved selection and evaluation procedures to produce new crops for Northern Australia

CSC-49A 92

Identification of success factors in the development of new agricultural industries in Northern Australia

R&D Planning

AGT-1A 99

Assessment of commercial prospects and research priorities for new industries

DOW-1A

Review of new plant products program

FAS-1A

Review of new plant products program

Property rights

MS967-26 97

Expenses regarding intellectual/royalty issues etc.

(Continued on next page)

3.20 **Project — classification and initial assessment Miscellaneous** (Continued)

I	II	III
Termites		
	Production — pest/weed CSE-23A 93 Biological and chemical management of the giant termite, *Mastotermes Darwinensis*	
Acacia salinga		
	Production — systems CUT-6A 02 Acacia salinga as a fodder source for ruminants	
Legaminous browse		
Production — breeding UT-25A 03 Leguminous browse species as forage plants for temperate environments		
Saltbush		
Production — reproduction DAW-27A 93 Production of high quality seed from Atriplex spp.		
Canary seed		
	Production — systems UM-92A 01 Canary seed industry development for Southeastern Australia	

(Continued on next page)

3.20 **Project — classification and initial assessment Miscellaneous** (Continued)

Desert ephemeral

Market — research

UWS-6A 96

Desert ephemeral plants as teaching tools

Duckweed

Processing — simple

BWM-1A 98

Duckweed — a potential high protein source for supplementation of feeds for domestic animals and fish

Grass

Production

Harvest — management

CCA-1A 93

Weeping grass — developing techniques to maximise seed harvesting

Systems — management

UNE-35A 96

Commericalisation and development of an agronomic package for microlaena stipoides for forage and other purposes

Mustard

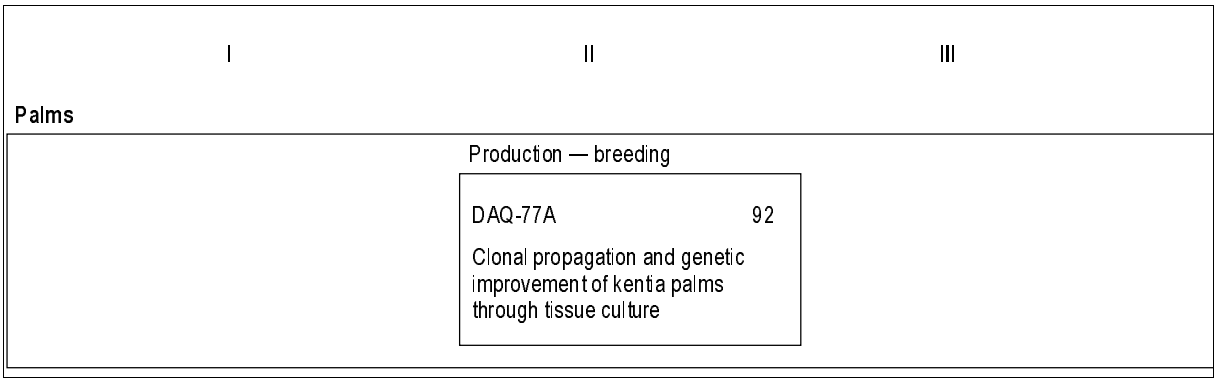
Production — systems/breeding

DAV-31A 93

Development of a mustard industry in North West Victoria

(Continued on next page)

3.20 **Project — classification and initial assessment Miscellaneous** (Continued)



Initial assessment

The initial assessment is based on the project manager's judgement of the outcome of the project. A summary of each project group, as set out in chart 3.20 is provided. About half the projects have focused on general industry issues, and the other half on a specific product or groups of products. Table 3.21 summarises the assessment.

3.21 Projects — classification and initial assessment Miscellaneous

Project	*Stage*	*Level 1*	*Level 2*	*Level 3*	*Code*	*Evaluation*
Assessment of Commercial Prospects and Research Priorities for New Industries: Methodological Review and Development	1	Industry training and development	Development	R&D Planning	AGT-1A	Medium
Emerging Opportunities in Agriculture Conference	1	Communication/technology transfer	Industry	Seminars	AST-1A	High
Duckweed — A Potential High Protein Source for Supplementation of Feeds for Domestic Animals and Fish	2	Processing	Simple	Evaluation	BWM-1A	Not known
Weeping Grass — Development of Techniques to Maximise Seed Harvesting	2	Production	Harvest	Management	CCA-1A	Not known
Identification of Success Factors in the Development of New Agricultural Industries in Northern Australia	1	Industry training and development	Development	Benchmarks	CSC-49A	High
Acacia Saligna as a Fodder Source for Ruminants	2	Production	Production systems	Plant physiology	CUT-6A	Too early
Clonal Propagation and Genetic Improvement of Kentia Palms through Tissue Culture	2	Production	Breeding	Genetic	DAQ-77A	Not known
Development of a Mustard Industry in North West Victoria	2	Production	Systems Breeding	Management Selection	DAV-31A	Not known
Production of High Quality Seed from Atriplex SPP.	1	Production	Reproduction	Mangagement	DAW-27A	Not known
First National New Rural Industries Conference, Perth 1998	1	Communication/technology transfer	Industry	Seminars	DAW-90A	Medium/High
A Reference Manual on New and Emerging Rural Industries	3	Communication/technology transfer	Industry	Publication	HYD-1A	High

Project	Stage	Level 1	Level 2	Level 3	Code	Evaluation
A Statistical Summary System for Reports on RIRDC Portfolio Industries	2	Communication/technology transfer	Industry	Information systems	HYD-2A	Not known
Canary Seed Industry Development for Southeastern Australia	2	Production	Production systems	Viability	UM-42A	Too early
Commercialisation and Development of Agronomic Package for Microlaena Stipoides for Forage and Other Purposes (Joint Agreement with MRC)	2	Production	Systems	Management	UNE-35A	Medium/High
New Crops: Development and Application of Improved Selection and Evaluation Procedures to Produce New Crops for Northern Australia	1	Industry training and development	Development	Benchmarks	UQ-33A	High
First Australian New Crops Conference	1	Communication/technology transfer	Industry	Seminars	UQ-44A	Medium/High
Australian New Crops Newsletter	3	Communication/technology transfer	Industry	Newsletter	UQ-80A	High
Preliminary Investigation on 'French' Black Morel Cropping (Morchella Angusticeps)	1	Markets	Market research	Opportunities	UT-12A	High
Leguminous Browse Species as Forage Plants for Temperate Environments	1	Production	Breeding	Evaluation	UT-25A	Too early
Desert Ephemeral Plants as Teaching Tools	1	Markets	Market research	Opportunities	UWS-6A	Medium

Source: RIRDC database and files.

General

Industry development — There have been 6 projects that worked to assist in the development of the new plant industries. Several have concentrated on developing benchmarks, three on R&D planning and one on establishing property rights.

- UQ-33A *New Crops: Development and Application of Improved Selection and Evaluation Procedures to Produce New Crops for Northern Australia* began at CSIRO as a project aimed at setting up a method for screening and recognising new crops with potential. It changed direction however, and became less technical. It established a conceptual framework for setting up new industries. It has had some significant outcomes, such as the new crops newsletter previously mentioned, field days and student projects. It has also lead to DOR (Do your Own Research) marketing courses for people involved in, or wishing to be involved in new industries. This course has had effects in the bushfood industry in particular, with producers' behaviour being changed markedly. The project has therefore had a high impact.
- AGT-1A *Assessment of Commercial Prospects and Research Priorities for New Industries: Methodological Review and Development* was stimulated by the need for methods to assess project applications. Increasing competition on research funds has put further pressure to ensure that these funds are used efficiently. A model was developed for the tea-tree oil industry for assessing prospects and R&D needs, which was judged to be valuable. There is potential to develop similar useful models for other emerging industries. The findings have had effects on RIRDC's R&D policies, and has been viewed as part of the learning process that needs to be done. The impact that it has had has been judged to be medium.
- CSC-49A *Identification of Success Factors in the Development of New Agricultural Industries in Northern Australia* looked at factors that affected an industries' success in the past and provided guidelines for RIRDC to assist in identifying the best initiatives. The study involved looking at the histories of thirty five different industries. The final two volume report had a high impact on decisions made on R&D, particularly by the research manager.

Communication — There have been six projects which have aimed to improve communication across the industries developing new crops and new plant products.

- HYD-1A *A Reference Manual on New and Emerging Rural Industries* resulted in a handbook that profiled RIRDC's role in, and provided information to farmers and investors on, emerging new industries. It is one of RIRDC's best sellers, so the impact would be very high.
- HYD-2A *A Statistical Summary System for Reports on RIRDC Portfolio Industries*.
- AST-1A *Emerging Opportunities in Agriculture Conference* was a field day in Harden that was well attended. It was showcasing some of the opportunities that are available in the new industry program. There was some exposure so the impact would have been high.
- UQ-44A *First Australian New Crops Conference* was similar to the above project but in a more formal setting. This was also well attended and some good information was presented. This conference and the issues that were raised during it are referred to regularly, so it would be judged that this project had a medium/high impact.
- DAW-90A *First New Rural Industries Conference* crossed the boundary between plants and animals. It was considered to be a stepping stone to many programs by looking at the processes associated with the development of new industries. A workshop the day after the conference, funded by AFFA, determined areas that attention needed to be paid to. It led to the introduction of the New Industries Development Program last budget. This initiative assists commercialisation and is designed to complement RIRDC's work, so RIRDC is represented on the board. It is a good prospect for evaluation, with the expected payoff being medium/high.
- UQ-80A *Australian New Crops Newsletter* was an offshoot of UQ-33A and has become a very popular newsletter. The New Crops Association was temporarily unable to run the newsletter, so RIRDC contributed to its operating costs. The newsletter is highly regarded in Australia and overseas, and this support would have had a high impact.

Termites

Little is known about the project. CSE-23A *Biological and Chemical Management of the Giant Termite, Mastotermes Darwiniensis*

Fodder

Acacia salinga — CUT-6A *Acacia Salinga as a Fodder Source of Ruminants* is looking at ways the nutritional restrictions of A.salinga can be overcome if it is to be a fodder source for animals. It has good potential but it is too early to evaluate.

Leguminous browse — UT-25A *Leguminous Browse Species as Forage Plants for Temperate Environments* has just started, so it is a bit too early to make any judgement on the impact of the research. The focus of it is to trial a number of cultivars in Tasmania and Victoria for the inclusion in pasture. This would be desirable because leguminous browse is very nutritional and has beneficial effects on nitrogen in the soil.

Saltbush — DAW-27A *Production of High Quality Seed from Atriplex SPP* was driven by the need to find salt resistant plants. Saltbush stands can be used to revegitate saltlands and provide feed for growing stock during autumn. The lack of quality is an important contributor to establishment failure, which is the problem this project deals with. The environmental characteristics of establishment sites were identified, but further work is continuing on the selection of appropriate male and female genotypes for seed production.

Other plants

Canary Seed

UM-42A *Canary Seed Industry Development for Southeastern Australia* has just started so is too early to evaluate. The aim is to develop and promote appropriate crop management practices, suitable varieties and a marketing package.

Desert Ephemeral — UWS-6A *Desert Ephemeral Plants as Teaching Tools* aimed to develop teaching tools and procedures for the use of these plants. Teaching tools traditionally come from the US or Europe, however indigenous ones could be more useful. Only one species out of four was suitable for using as a teaching tool, and teaching materials have been developed for it. The project has been reasonably successful so the impact would have been medium.

Duckweed — Duckweed has great potential to remove mineral contaminants from wastewater emanating from Sewage Treatment Works, etc. BWM-1A *Duckweed- A Potential High Protein Source for Supplementation of Feeds for Domestic Animals and Fish* looked at technologies to dry the duckweed and use it as a high protein feed supplement for animals. Bio-Tech Waste Management identified an economical method for drying harvested duckweed. It also conducted trials in using this feed with excellent results. In some cases it was not necessary to dry the duckweed. Laws just introduced that require any business in New South Wales to clean wastewater to EPA standards may enhance the project's worth.

Grass — Several projects have looked at grasses.

- CCA-1A *Weeping Grass- Development of Techniques to Maximise Seed Harvesting*
- UNE-35A *Commercialisation and Development of an Agronomic Package for Microlaena Stipoides for Forage and Other Purposes* investigated Microlaena which has a great potential for a wide variety of commercial uses such as for pasture or even human consumption. It has the advantage of not requiring much water, so it is a low maintenance native crop that has conservation implications. Three varieties were PBR registered. Various optimal practices were identified and production blocks have been established in various areas. There are some post-harvest treatment problems, but the Australian Native Grass and Legume Seed Industry Association has identified *Microlaena* as a priority. The NPP Review said that it was too early to say what kind of impact this would have on industry and any judgement would have to wait until 2001. However, it is looking pretty good so probably will result in a medium/high impact.

Mustard — DAV-31A *Development of a Mustard Industry in North West Victoria* identified potential lines of mustard that could be a success in Victoria. It had a medium/high impact on further work conducted by the GRDC on mustard.

Palms — *DAQ-77A Clonal Propagation and Genetic Improvement of Kentia Palms through Tissue Culture*. Little is known about this project.

Further evaluation

Four groups of projects were recommended for a benefit cost assessment.

- DAQ-170A and DAQ-194A *Callide Valley Herb and Spice Trial* is a search for an alternative crop in a region which experienced substantial reductions in the availability of water.
- Five projects on production and harvesting issues for coffee were evaluated. The return on the projects is in the low to medium range. The projects are:

- *DAQ-95A Australian Coffee Industry Research and Development Program*
- *DAQ-161A Technology Package for Australian Coffee.*
- *DAQ-160A Commercialisation of the Walkamin Coffee Processing System*
- *DAQ-159A Management Strategies for the Cultivation and Mechanical Harvesting of Coffee,*
- *DAN-100A Demonstration and Evaluation of Mechanical Harvesting in New South Wales*

- Two projects addressing a wide range of production and market issues for buckwheat had proved on evaluation to have a good return. They are:
  - *DAV-86A Production and Export of Buckwheat Grain and Value Added Products.*
  - *DAV-136A Total Quality Management for the Production and Marketing of Buckwheat and Honeybee Pollination of Buckwheat.*
- Two lentil projects that developed several new varieties of lentil for successful export have provided a good return on the investment. The projects are:
  - *DAS-9A Development of Premium Quality Lentils Adapted to Australian Environments and Technology*
  - *DAS-34A Lentil Improvement and Development for Southern Australia through Selection and Breeding.*

4. References

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