International Alternate Bearing Summit: Phase One of Alternate Bearing Solutions for Growers

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Avocados Australia Limited (AAL)

Project Number: AV09009

AV09009

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Avocados Australia

HAL Project

AV09009 International Alternate Bearing Summit: Phase One of Alternate Bearing Solutions for Growers

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May 2011

Project details

Project Name: International Alternate Bearing Summit: Phase One of Alternate Bearing Solutions for Growers

Project Number: AV09009

Date: May 2011

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Summit Supporters

Avocados Australia

Californian Avocado Commission

South African Avocado Growers Association

New Zealand Avocado Growers Association

Media Summary

The effects of alternate bearing (AB) and irregular bearing (IB) create major challenges to growers and marketers of avocados throughout Australia and the world.

The AB problem is common to most tree fruit crops, and varies in intensity, AB can manifest countrywide, regionally, on a specific farm and even in the branches of a single tree. AB is typically initiated by an abnormally heavy or light crop in young trees, followed by a light or heavy subsequent crop. This pattern then becomes entrained and difficult to change unless severe climatic events intervene, or drastic management interventions are made. A heavy "on" crop results in reduced vegetative shoot and root flushing, and less carbohydrate (energy reserves) build-up. Seed gibberellins may also reduce flower bud initiation. Fewer flowering and fruiting sites for next season's cropping are formed, and flowering intensity is reduced. Many complex interacting factors affect AB intensity.

The issue of AB in avocados is seen in varying degrees across all production areas in Australia and also globally.

This Summit seeks to establish a large scale international project in partnership with New Zealand, USA, Mexico, Chile and South Africa, to challenge the understanding and develop solutions for the issue of alternate bearing in avocados.

Australian research capacity is limited in this area of science, as is the world. The ability to work jointly and draw on the avocado researchers and funding is the only way the Australian industry will be able to achieve a positive improvement.

Summit Program

Introduction
The effect of avocado alternate bearing is a major issue facing the global avocado product group. A number of individual science studies, related to avocado alternate bearing, have been conducted, providing a platform for future, and more integrated, solutions development. It is likely the solution system will comprise a complex mix of best practice and intra- and inter-system relationships, based on data, soft observations and further-system inputs.

Project Outcome
The desired outcome of the project will be the partial, or total mitigation, of avocado alternate bearing across sequential seasons and individual production sites. The Avocado Research Consortium expects the solutions to avocado alternate bearing will require application of elite expertise, across a range of science, technology and innovation disciplines.

Summit Objectives

1. Convene subject-matter experts to discuss avocado alternate bearing to include;
    a. main themes or platforms
    b. current and potential future scope of work required to provide a solution
    c. key global resources

2. Establish a network of subject-matter-expert stakeholders
3. Discuss a Consortium project framework

Summit Format
The Summit format follows Gordon Conference guidelines with the exception of a summary document to be produced and shared with participants.

International Alternate Bearing Summit - Half Moon Bay, California
September 27 – 29, 2010

AGENDA

Monday September 27	Afternoon	Participants arrive in afternoon at hotel
	6.00 p.m.	Networking Pre-dinner drinks at hotel
	7:00 p.m.	Dinner at hotel During the dinner there will be a Summit welcome from CEOs = Avocado Research Consortium ▪ Welcome ▪ Introductions ▪ Overview of Avocado Research Consortium ▪ Summit format & objectives

Tuesday September 28	7:00 – 8:00 a.m.	Breakfast
	8:00 – 9.10 a.m.	Mark Burrell – Summit Facilitator Summary of session flow and form Introductory Speaker: Jonathan Dixon Overview of alternate bearing Establishing the five key themes for Summit sessions
	9:10 –10:15 a.m.	Whiteboard session
	10:15– 10:35 a.m.	Coffee break
	10:35 – 12:30 p.m.	**Session 1** Theme discussion
	12:30 – 1:30 p.m.	Lunch
	1:30 -2.00 p.m.	Group Photo (Photographs will also be taken throughout the Summit and made available to all participants)
	2.00 – 3.00 p.m.	**Session 2** Theme discussion
	3.00 – 3.30 p.m.	Afternoon break Participants confirm scheduled departure times on Wednesday for transfer arrangements
	3.30 – 5.00 p.m.	**Session 3** Theme discussion
	6.00– 7.00 p.m.	Networking –hotel
	7.00 p.m. onward	Dinner –local restaurant Semi-formal Summit participants and guests
		Confirm any hotel and airport-transfer requirements for Wednesday with April Aymami (Organising Team)

Wednesday September 29	7:00 – 8:00 a.m.	Breakfast *Note: hotel checkout 11.00 a.m.*
	8:00 – 10:15 a.m.	**Session 4** Theme discussion
	10:15 – 10:35 a.m.	Coffee break
	10:35 a.m. – 12:30 p.m.	**Session 5** Theme discussion
	12:30 – 1:30 p.m.	Lunch
	1:30 – 3:00 p.m.	*(Session 5 – continue further discussion, as required)* **Session 6** Synthesis of themes and theme inter-relationships Agreement, in principle, on scope of challenge for avocado Who else should be in our science community of interest? (names)
	3.00 – 3.30 p.m.	Afternoon break
	3:30 – 5.00 p.m.	**Session 7** As time allows; ▪ Project architecture – current thinking ▪ Feedback and discussion ▪ Next steps ▪ Close – Project Consortium
		Transfer to SFO for departure Transfers may commence earlier to fit with flight schedules

International Alternate Bearing Summit - Half Moon Bay, California
September 27 – 29, 2010

Participants

	Last Name	First Name	Country
1	Schaffer	Bruce	USA
2	Rosenstock	Todd	USA
3	Arpaia	Mary Lu	USA
4	Brown	Patrick	USA
5	Smith	Harley	USA
6	Lovatt	Carol	USA
7	Hormaza	Iñaki	Spain
8	Cuevas	Julian	Spain
9	Bower	John	South Africa
10	Leonardi	John	Australia
11	Wilkies	John	Australia
12	Hanke	Viola	Germany
13	Sadka	Avi	Israel
14	Irihimovitch	Vered	Israel
15	Ish-Am	Gad	Israel
16	Samach	Alon	Israel
17	Cohen	Hadar	Israel
18	Gafni	Udi	Israel
19	Magdahl	Christian	Chile
20	Mena	Francisco	Chile
21	Gil	Pilar	Chile
22	Thorp	Grant	New Zealand
23	Minchin	Peter	New Zealand
	Industry support/management		
24	Allen	Antony	Australia
25	Bellamore	Tom	USA
26	Dixon	Jonathan	USA
27	Aymami	April	USA
28	Hanson	Angie	USA
29	Ryan	Dan	New Zealand
30	Thorn	Alan	New Zealand
31	King	Hugh	New Zealand
32	Pak	Henry	New Zealand
33	Burrell	Mark	USA


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Key Outcomes

The key outcomes from the summit include:

Summit Objectives:
A discussion on alternate bearing mostly focused on avocados that is free flowing, has broad participation, themes for discussion and facilitates international collaboration.

Session 1.
Establishing the themes.

The following ideas were raised and discussed in this session:

- Alternate bearing is a form of "masting" as seen in "wild-type" trees
- Therefore "wild-type" avocados could be examined to give clues for understanding alternate bearing
- Alternate bearing is not always biennial bearing and can occur in bigger cycles of two or three years
- Alternate bearing is based on the crop load
- Use varietal differences to understand alternate bearing as is based on the genotype so need to examine a large number of cultivars - differences in the genetic component and tree architecture etc.
- Look at mechanisms that stop the flowers setting fruit or encourage setting of fruit
- Trying to overcome a natural occurrence
- Understanding the triggers of alternate bearing so what brings it on
- The importance of rootstocks
- Nutrition effects
- Alternate bearing cultivars cannot annually determine crop load
- Crop load affects the switch to flower not the amount of flowers

The following questions were raised in the discussion that followed in order establish how the themes would be decided:

- What is the definition of alternate bearing?
- What is the genetics of alternate bearing?
- What is the role of growth regulators?
- What tools are available to minimize alternate bearing?
- What are the mechanisms that initiate and then perpetuate alternate bearing?
- Should the mechanisms at each stage of the tree growth cycle be used to explain alternate bearing?
- What causes the exceptions where alternate bearing does not express?

There was agreement on examining the consequences of heavy bloom, heavy crop load, fruit/shoot/root growth/flower initiation.

A consensus was reached to examine in the discussion alternate bearing in the context of:

Using a phenological model with Hass as the model system. Doing this it should be possible to deliver information to growers and to integrate science into applicable information.

Session 2.
Theme: Bloom.

Professor Carol Lovatt, UC Riverside gave a presentation summarized below on her alternate bearing research of avocado trees in California.

- When season starts with heavy on bloom there is a reduction in amount of summer shoot growth
- In California summer shoots contribute the bulk of bloom, spring shoots contribute one third and fall shoots less than one third
- There are weaker flowers on fall flush compared to flowers on spring or summer flush
- In California bad weather is experienced often during bloom; therefore, fall-flush produces equal yield to trees that set early on spring and summer flush

- Removing fruit from June through September substantially increases flowering and return yield
- When the setting crop was removed and mature fruit retained, summer and fall shoot growth was reduced
- When fruit were removed in October/November, there was less bloom than if fruit were removed in summer
- However, once fruit removal extended past November, the only return bloom was on-spring shoots; the later you wait, the less return bloom there is
- Then, in March/April (approximate flowering time in California), you get off bloom; followed by an off crop and significant amounts of summer and fall flush this is then followed by a heavy-bloom cycle
- When fruit exists on a shoot on on-crop tree, the buds do not flower once you extend hanging the fruit through December
- Flower induction is the transition from vegetative to reproductive growth
- Induction of flowering occurs from late July through August in California (late Feb to March Southern Hemisphere?); when the tree is still growing new flushes (the avocado is considered to be an autonomous flowering plant, so the flush grows for a certain amount of nodes and then develops flowers)
- With fall shoot growth; in certain years, shoots become floral buds and, in other years, remain vegetative (thought to be largely based on weather)
- Buds are irreversibly committed to flowering by October; by November, all 10 auxiliary branches are inflorescences
- October 30 in California is the date of the first irreversible change where four auxiliary/lateral branches out of inflorescences can be detected
- Bulk of flowering shoots are indeterminate; determinate shoots are produced in the "on bloom" mostly by summer shoots
- The time between induction and final commitment to flowering is: July/August through October in California (February/March through May in Southern Hemisphere)

In the discussion that followed the following questions were raised:

- Are there independent pathways that lead to induction; therefore it is not possible to easily determine the fate of single buds? - for example one pathway might begin induction/initiation moving earlier than a second pathway
- Can in an off-year, a fruit-bearing shoot flower like a shoot on on-crop tree where perhaps the majority of shoots coming from spring shoots
- There are occasions where temperatures can increase in winter and some trees can flower; however, the winter flowering doesn't usually set fruit
- Has it been tried removing all fruit from tree? No, but there should be an effect, in terms of what fast-growing fruit are exporting
- What factor(s) lead to no fruit, when you experience sparse flowering?
- Is the loss of fruit set post fertilization?
- Do we know the percentage of flowers that are successfully fertilized vs. dropped flowers? And, where limitations in fruit set exist?
- With respect to flowering quality are there differences among flower starch levels?
- Do starch levels affect flower quality?
- Most flowers are low quality, so don't have enough starch to survive, regardless of pollination and fertilization
- Reason you have low production is lower number of inflorescences with high starch
- Is there any way to change flower quality, in terms of starch and reserves (what we know, don't know and windows of opportunity)?
- Do off bloom flowers display better quality than on bloom flowers?
- Is fruit set higher in off bloom vs. on bloom?
- When two consistently good crop years occur, what characteristics are present in the second year; is it the number of flowers, quality of flowers, etc.?
- Does boron deficiency play a role in alternate bearing? What is the role of boron in fruit set?
- Inadequate perseitol transport of boron could cause boron deficiency
- Is it worthwhile comparing drop flowers and non-drop flowers to gauge measurable deficiencies?
- Sugar levels shift dramatically during temperature fluctuation
- Example; in on year and off year, there are few flowers, but fruit set increased 300%; what happens to tree the following year?

- Are flowers equally viable in fall, spring, summer?
- What's the relation between flower and yield potential; how much vegetative growth is necessary to provide good floral points?

The Key scientific questions on bloom were:

- What is the productivity of different flushes?
- Is the timing of flower induction the same everywhere?
- Is the timing of productive flush known?
- What are the molecular markers for induction of flowers?
- Are there alternatives to plant growth regulator applications to manipulate flowering?
- What is the ideal state (of the tree? flowers? flush?) trying to achieve for a solution?
- What is the role of Boron and how does it relate to yield determinants?
- What is the role of developing fruit and the feedback mechanisms?
- How do the plant growth regulators in the seeds affect alternate bearing?
- What is the impact of fruit removal on bud development?
- What are the differences in bearing vs. non-bearing shoots and their plant growth regulators differences?
- What is the correct timing of plant growth regulator application?

For cultural matters:

- There is a need to define the ideal state of flowers and inflorescences
- What is the relationship between resources and signals to bloom?

Session 3.
Theme: Crop Load.

The Key scientific questions on crop load were:

- What influences the timing and causes the flower and fruit drop?
- What role does fruit growth play where purportedly larger fruit inhibits the slower-developing fruit?
- Is there a difference in self vs. crossed fruit in higher fruit retention?
- What causes the variable response to girdling?
- What role does the accumulation of high IAA play in seedless fruit (cukes)
- Is there a root signal?
- Can carbohydrate injection be used and what would its impact be? Could fruit removal change low glucose/high starch ratios, the flux/compartmentalization of carbohydrate and Hexokinase, etc?
- What is the optimal crop-load threshold where alternate bearing does not occur?
- What is the effect of mature crop on return bloom?
- What is the impact of late-harvest impacts?
- What is the impact of pruning?
- What is the role of C7 sugars?
- What are the source/sink relationships?
- What is the ideal ratio of shoot tips/fruiting shoots?
- What is the consistent fruit-sizing science?
- How to use plant growth regulators for sizing (Australia/South Africa) in off year for volumes and fruit size increase?
- Are there tools that exist to measure fruit size before harvesting?
- Could fertilizer could be causing fruit drop?
- Is self pollination causing fruit drop and the self vs. crossed fruit have different retention rates?
- What is the role of girdling in fruit set?
- What are carbohydrates' and hormones' roles in fruit set?
- Would injecting carbohydrates into avocados be a worthwhile experiment?
- If it was known how to correctly perform tree injections, the scientific experiments could improve tremendously, and identify what factors are responsible for changes.
- What is needed is the ability to measure carbohydrate fluctuations, rather than using only initial carbohydrate measurements (measuring fluxes is difficult).
- Are carbohydrates acting as signaling systems?
- What is the carbon sugars effect on crop set and fruit load?

It was proposed that experiments be established in different countries looking at crop load; what level of crop load triggers alternate bearing and how do agricultural conditions influence (would there be a need to establish certain variables).

The Key scientific questions on pollination were:

- Can flowers be hand pollinated in off year?
- Is every flower potentially viable?

Session 4.
Theme: Shoot inhibitors

The Key scientific questions on shoot inhibitors were:

- Is the ratio of auxin to cytokinin causing alternate bearing or is it the transport of auxin vs. concentration?
- Do vigorously growing shoots inhibit production of floral buds?
- Can molecular studies be used?
- If a synonymous chemical is emerging from all fruit species (avocado, citrus, etc.) and causing growth cessation, that chemical could be determined and then can identify molecular similarity across fruit species?
- Do we have any evidence that chemical is different?
- What is the role of seed coat in fruit development?
- Is an inhibitory substance exerted during any early fruit stages?
- Is there a benefit to studying other systems/commodities to determine if a common chemical exists in various commodities?
- Is using a different commodity and then applying the findings to Hass useful to help solve avocado alternate bearing?
- Should the identification of the genes that control flowering in avocado be the first step in attempting to solve alternate bearing?
- What signals control activation of these genes as they may be similar in other species or unique to avocados?

It was suggested to conduct a general study on alternate bearing that controls select variables; then, examine phytohormones in stem, gene expression and carbohydrates as this could determine the genes induced.

It was also suggested there is also a need to determine if there is an alternate bearing trigger in flowering. Knowledge of this will help determine if alternate-bearing mitigation steps are working, or if new ones are needed.

It may be important to determine the avocado-genome sequence. In Mexico, ongoing study that has sequenced much cDNA, but not in a commercial avocado cultivar, with the project about 80% complete.

There was also a suggestion to follow a more medical style research approach when testing genomics of avocados.

Session 5.
Theme: Flowering.

The Key scientific questions on flowering were:

- Flower-induction can be studied in three subcategories as:
    - Detecting signals
    - Transport
    - Meristem commitment to flowering
- When does the tree make decisions on flowering throughout the season, which activate the above?
- How does fruit load affect flower induction?
- What is the mechanism that generates or inhibits a flower being produced?
- There is a need to identify what, in the plant, is switching the FT genes on and off; in avocados it should be possible to remove the environment factor and look more closely at inhibition of the FT gene
- When is FT higher and how is FT influencing alternate bearing?
- Further study for when flowering induction really occurs is needed

- Identify which flowering genes are produced (and in what cell types) in plant growth regulator treatment?
- What is the fruit vs. seed role in flower induction?
- Need to identify integration among anatomy, triggers, environment and molecular but keep it in context
- There is a need to focus on the amount of flowers
- Determining when flower induction occurs is a good starting point; transition to floral development in July/August (and other times)
- What is the role of low temperature on inflorescence formation?
- What is the role of root growth and cytokinin production on flowering?
- Study the following situations when there is a lack of bloom
    - The tree is too heavily loaded
    - A branch that grows too fast and too strong and does not bloom
- How can pruning methods be used to try and control alternate bearing through "tree balance" between vegetative and reproductive growth (rootstock reduces vegetative growth); avoid excessive pruning, as pruning incites vegetative growth
- Is it possible to use fruit thinning in "on years"
- What is the correct timing for cutting trees to stumps?
- Is early nutrition management important and could a decision-support tool be used?
- What is the relationship between timing of induction and cultural practices?
- Are practices to inhibit alternate bearing well known?
- Are there fertilizer strategies that can be used so that growers can be advised of the correct timing to apply inputs for better management of alternate bearing?
- Would precision agriculture be useful?
- Is there a need to have a better understanding of the timing in practices but this may improve yield but not necessarily improve the alternate-bearing nature of avocado trees
- Is there a deficiency in knowledge of micro fertilization (basic knowledge of macro fertilization) that can be improved upon?
- It was suggested it is risky to attempt to influence productivity or alternate bearing through nutrition
- What is the tree-tree variability in alternate bearing and can this identify the genetic factors vs. management factors?

Session 6.
Theme: Integrating the science.

<u>The Key scientific questions on integrating together mechanisms were:</u>

The focus of studies should be on sustainable production, rather than maximum annual production, therefore the questions are:

- Does the Hass variety have the ability to produce sustainably?
- Should a new rootstock be examined?
- Is thinning flowers a potential solution?
    - When is the best time to thin flowers?
    - Can thinning be achieved through pruning?
    - Is there a greater cost benefit to size or productivity?

Suggested not to focus on sustainability but need to determine existing technologies to help growers avoid the alternate-bearing result. The real driver of whole issue is fruit number/fruit load. If the initial crop can be managed it will be easier to manage future crops.

Where is science integration most likely to occur?

- Meetings such as the Summit
- Through the use of modeling systems
- Face to face meetings between researchers
- To successfully collaborate, must understand global-environmental impacts
- Must determine treatments to be used; similar methodologies
- Network science; look at ecology community
- Not necessary to precisely replicate experiments in every country
- Someone facilitating QAQC and setting up database is likely the person missing from this conversation

A comment was made that it appears risky to work on one cultivar

- Working on different cultivars is difficult, as market driven by Hass, customers want the Hass appearance and market is ultimately consumer driven
- Hass is the dominant cultivar in California, Chile, Spain, New Zealand, Australia and is still important in Israel and South Africa

What were seen as the barriers to integration:

- The amount of money and personnel resources
- Agreement on particular issues to work on and what is known (goodwill?)
- Realistic expectations of the time it takes for experimentation to generate replicated results
    - Five-years worth of data not sufficient for alternate bearing
    - Alternate bearing continues to reset in California, with freeze, heat, etc.
    - Must overcome gap between researchers' timing and growers' timing (researchers want longer, growers want immediate, as they might not be in business to see results of long-term project)
- Must have solution-management system to provide growers, in order to verify results will be delivered
    - Projects need to be managed with milestones, deliverables, etc.
- Mechanisms will be important and will alter research practices, as necessary, if not working; allows better understanding of factors affecting fruit growth
- Chromosomes and genes (sequences); markers and new technologies to boost ID, but skeptics remain
    - Multiple sequencing tools available, so can conduct faster research
    - New technology

Session 7.

<u>Moving Forward/Developing Scope:</u>

- If we can modify fruit load, what are the effects and is this a good starting point?
    - Behind the scenes researchers can look more closely at physiology and mechanisms
- Examine the systems other commodities have established
- Doubt was expressed if genome research was ever going to be helpful as there seems to be a very long time taken establishing "markers"
- Look at networking model used for ecological studies suitable for very broad-based scientific studies
- What should the mix of short- versus long-term projects be?

Main issues/overview:

The effect of crop load on return bloom

- **Shoot and root growth; fruiting vs. vegetative balance**
- **Most discussion has been on effects of alternate bearing on meristems, i.e. the shoot and root growth, boron, crop load, plant growth regulators, bloom, inhibition of flower development, signals, and so on**
- **In addition the follow on is to look at solutions, i.e. fruit thinning, optimization of pollination, girdling, flower thinning, use of plant growth regulators**

Session 8.

<u>Post-presentation feedback/Wrap-up:</u>

Should the consortium be looking for competitive bid from a variety of research/scientific communities?

- Suggested yes; there needs to be competitive bidding and reviewing (third party) processes
- Suggested no; that, instead, coordinate research teams, as Summit participants have formed good alliances and collegiality should be encouraged, rather than pitting researchers against one another
- Don't want to create structure that establishes competing camps trying to out-strategize one another

Suggested establishing focus groups of growers within each country, therefore, growers help identify the problems resulting in the project starting at the orchard or grove.
Suggested there should be a survey asking for the most pertinent questions among each country's growers and then send survey to researchers

- Research questions should be relevant to alternate bearing

- Ultimately, want to determine what is known and unknown about alternate bearing, and, then, deliver a list of questions to researchers

Then, once request for proposals are ready, the consortium Board should set a budget.

Independent scientists from those submitting the proposals can then help analyze and filter the proposals.

Finally answers will come from researchers.

Recommendations

The next project develop the key performance indicators or factors of the biological system under a number of environmental scenarios for selected avocado cultivars and present mitigation strategies for alternate bearing.

It is important to firstly describe what defines the commercial success of the project. Even if the project is successful the biological system consistency is likely to evidence variability rather than a cure to alternate bearing.

There are a number of ways that the project could be approached two of which are;

1. Determine a set of science projects arising from RFPs from which management tools can be developed or;

2. Create a decision support framework based on existing science/data and then focus on knowledge gaps for a core suite of scientific projects to include;
    a. risk factors and their influence – existing and new science
    b. dynamic systems modeling using the above and outputs from specific projects
    c. simple, intuitive and practical web-based calculators/tools for growers to input their data and react to the customized results

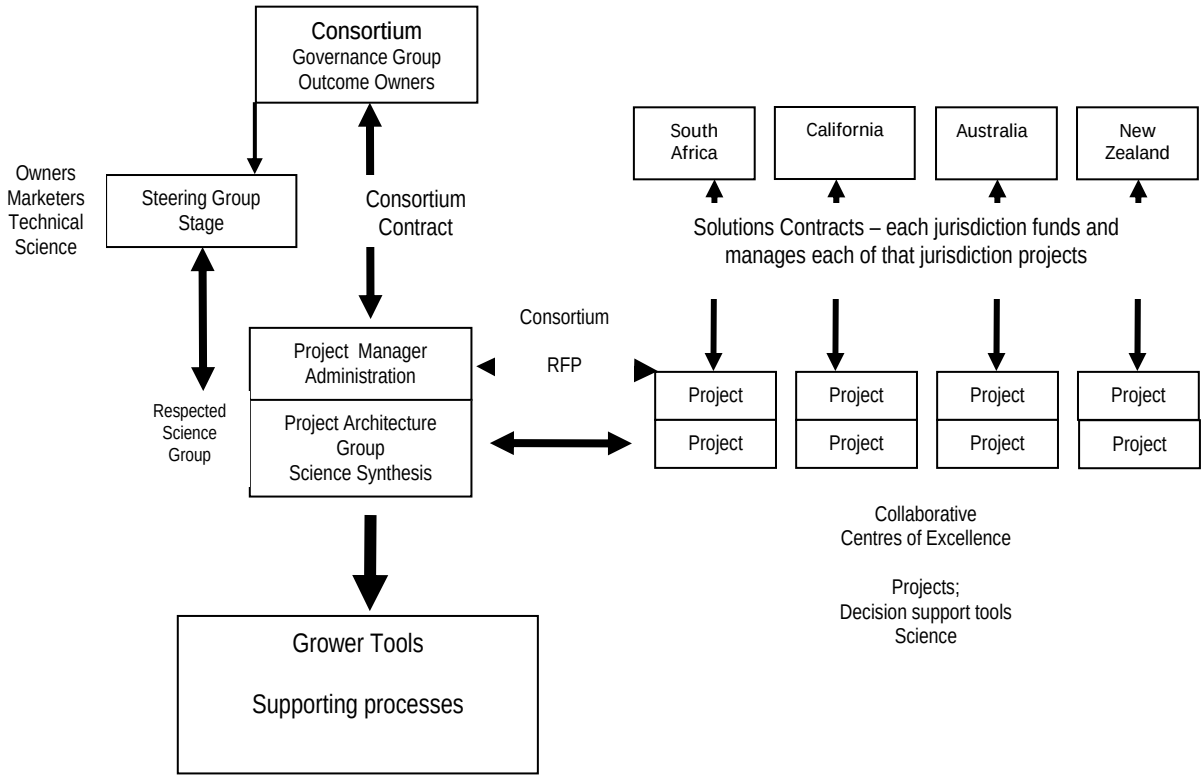
If a key project deliverable is a set of commercially affordable and effective decision support tools that are underpinned by an ongoing process of refinement and continuous improvement then Approach 2 has some attraction.

Engagement with growers from the outset would enable early testing of the basic decision support toolset and establish broad support for the initiative. If customized and combined interventions are used then consistent and objective measurements will be conducted on contributing orchards which implies the harmonization of standards and processes of data collection. To enable the decision support model and tools development to commence early would require the sharing of current industry data collection.

The duration of the project is approximately 5 years minimum to allow for theses, testing and validation of decision support tools. At year 3 there should be a general review of the outcomes and the approach.

The proposed structure is designed to;

- be simple and effective
- enable science collaboration across centres of excellence for a common good
- maintain objectivity of each of the project deliverables and ensure milestones are met
- provide a forum for freedom of thought and open debate
- be a synthesis of solutions options (debated and evolved, trialed and monitored)
- comply with the existing country entity jurisdictions for each of the agreed projects so as not to complicate administration (FX, tax etc)
- operate at low cost roll-out of beta-release decision support tools as early as practical to engage growers in data collection and live trials i.e. *the orchard as the lab*.


Consortium
Governance Group
Outcome Owners
Owners
Marketers
Technical
Science
Steering Group
Stage
Consortium
Contract
South
Africa
California
Australia
New
Zealand
Solutions Contracts – each jurisdiction funds and
manages each of that jurisdiction projects
Consortium
RFP
Project Manager
Administration
Project Architecture
Group
Science Synthesis
Respected
Science
Group
Project
Project
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Project
Project
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Project
Collaborative
Centres of Excellence
Projects;
Decision support tools
Science
Grower Tools
Supporting processes

Appendix 1: Summit Reconciliation statement

Description	*Budget*	*Actual*
Summit Program	$47,500.00	$47,948.00
Invitee Travel to Summit	$42,000.00	$37,702.00
Collection and Recording of AB Summit Discussions and Outcomes	$10,450.00	$14,749.00
Totals	$99,950.00	$100,398.00
Difference		-$448.00

Appendix 2: Documentation for the Summit

August 3, 2010

Dear, :

The organizing committee would like to invite you to attend and participate in the inaugural International Alternate Bearing Research Summit, on behalf of the following avocado industry associations: Avocados Australia; New Zealand Avocado Growers' Association; the South African Avocado Growers' Association; and the California Avocado Commission (Project Consortium).

The objectives of the first-ever Summit are to;

- Create an interaction and community of interest between subject-matter experts associated with alternate bearing;
- Identify research in progress and generate novel ideas to help solve the widespread problem of alternate bearing;
- Establish a framework of key themes associated with the expression of alternate bearing;
- Consider the next steps.

The Summit's Project Consortium believes that, in order to compile the most valuable insight, it is essential to convene the highest-caliber scientists and brightest minds, from around the world; irrespective of commodities. As a result, your attendance is deemed highly important when considering possible methods for solving alternate bearing; a feat that will ultimately lead to greater consistency in avocado production.

The two-day Summit – September 28 and 29 in Half Moon Bay, Calif. (outside San Francisco) – will be led by a Summit moderator and comprised of sequential panel sessions, supported by brief presentations to assist with context. We invite strong participation and are allowing the option to present subject matter; however, presentations are not mandatory.

It is the Project Consortium's belief that funding opportunities, which serve to further alternate-bearing research, will emerge from the Summit. Additionally, the Project Consortium is hopeful that information shared throughout the Summit might be collaboratively utilized by fellow researchers; however, following this meeting, no formal publication of the discussion will occur, unless complete consent by Summit participants is granted. Nonetheless, discussion regarding possible methods to communicate Summit outputs will occur.

While at the Summit, the Project Consortium will provide accommodations at the Oceano Hotel and Spa (where Summit sessions also will occur), as well as all necessary transportation, and meals throughout the two days. Please see the following for initial Summit details (further information will soon follow):

SUMMIT DETAILS:

1.) Monday, September 27:

- Guests arrive through San Francisco International Airport (SFO) and are transported to the Oceano Hotel and Spa in Half Moon Bay (about 40 minutes southwest of SFO); check-in commences at 3 p.m.
- Complimentary welcome reception at 6 p.m. at the hotel.

2.) Tuesday, September 28:

- **Breakfast:** 7 – 8 a.m.
- **Summit:** 8 a.m. – 12 p.m.
- **Lunch:** 12 – 1 p.m.
- **Summit:** 1– 3 p.m.
- **Afternoon Break/Tea:** 3 – 4 p.m.
- **Summit:** 4 – 5 p.m.
- **Dinner Reservations:** 7 p.m.

3.) Wednesday, September 29:

- **Breakfast:** 7 – 8 a.m.
- **Summit:** 8 a.m. – 12 p.m.
- **Lunch:** 12 – 1 p.m.
- **Summit Wrap Up:** 1 – 4:30 p.m.
- **Transport to Airport:** 4:30 p.m. and on

  **** Please note:*** *if travel plans require you stay a third night, on September, 29, please inform the Project Consortium, and we will provide accommodation.*

To enable a highly viable Summit, the Project Consortium is requesting your input in planning; therefore, prior to the Summit, we are asking you please send two items:

- ***A brief biography of yourself and your respective research interest in alternate bearing***
- ***Questions you would like proposed and/or topics you would like discussed***

We are asking you to please express your interest – or disinterest – in attending the International Alternate Bearing Research Summit, by Tuesday, August, 17, to April Aymami, California Avocado Commission, at **aaymami@avocado.org**. If you choose to attend, please include, in your response, your respective biographies and conference questions/topics. For those attending, a formal agenda will be distributed by mid-August.

To enable discussion prior to – and following – the Summit, a forum has been created on the Nature Network website, wherein researchers with an alternate-bearing interest are provided an outlet to interact in a credible-science forum. If you have not already done so, we would like to request you, at your earliest convenience, please consider registering and participating at: **http://network.nature.com/groups/alternate_bearing_of_trees/forum/topics**.

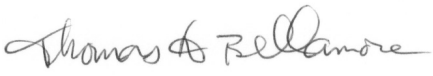
The Project Consortium extends its gratitude, in advance, for your consideration in attending the Summit; we greatly welcome the opportunity to collaborate with you there – and in the future. Solving the alternate-bearing challenge could alter production and financial landscapes for various commodities and growers, and we believe your knowledge can prove extremely beneficial in elucidating the great mystery.

If you have any questions, please contact Dr. Jonathan Dixon, California Avocado Commission, at **jdixon@avocado.org**.

Respectfully Yours,

Antony Allen, Avocados Australia, Chief Executive Officer

Tom Bellamore, California Avocado Commission, President



Derek Donkin, South African Avocado Growers' Association, Chief Executive Officer

Alan Thorn, New Zealand Avocado Growers' Association, Chief Executive Officer

AVOCADO RESEARCH CONSORTIUM

Request for Proposal

Project	**PROJECT AB1** (Project)
Version#	1
Date	December 2010
Client	Avocado Research Consortium (Consortium)
Project Contact	Name: Hugh King Email: chking@xtra.co.nz: Skype: hugh.king4 Phone: +64 7 579 1966 +64 274 691 000
Document Purpose	The purpose of this Request for Proposal (RFP) is to outline the Consortium project requirements for Innovation Partners (groups or individual commercial entities and individuals) with an interest in delivering a decision support system (DSS) for avocado Growers, under-pinned by research, to mitigate and manage alternate bearing on their orchard.

Introduction

The avocado Grower organisations in each of California, Israel, Australia and New Zealand have formed a Consortium relationship that will govern an international alternate bearing project (Schedule A). It is intended that other countries will also join the Consortium. The Consortium is a temporary relationship established for the sole purpose of a project collaboration to seek ways to reduce or eliminate the expression of alternate bearing in avocados and is not a taxable or any other type of entity permanently established or otherwise in any particular jurisdiction.

The affect on the commercial sustainability and market development caused by the alternate bearing of avocado is the major issue facing the global avocado industry. There have been a number of individual science studies related to the alternate bearing of avocado which provide a platform for future and more integrated solutions development. The Consortium has determined the need for an innovative and collaborative approach to developing a decision support system ("DSS") for Growers and recognizes that a complex array of environmental and biological elements impact alternate bearing. New avocado knowledge will be required to develop and then fine tune a DSS (Schedule B) for Growers.

The Consortium is seeking expert biological science and systems capability. For avoidance of doubt this project will contain both a DSS for Growers and supporting science projects related to the biological system that serve to close knowledge gaps. Planned and early engagement with Growers in each Consortium member country is an important part of any response to this RFP.

The Consortium views the project as consisting of two parallel streams of activity;

Part 1; Knowledge and Integration;

- Integration of existing science project outcomes
- Gap projects that directly enable the proposed solution and progressively integrated into the DSS

- Note: New knowledge gap projects identified during the project will be considered a scope change and evaluated by separate application, justification and approval by the Consortium and their advisors.

Part 2; Grower Decision Support System

- A DSS architecture built on a proposed solution.
  - * factor relationships
  - * site specific data collection, standards, processes, technology & data analysis.
- Site-specific information input and appropriately timed production management interventions x site outputs
- Best practice & rationale

Project Purpose & Outcome

The purpose of the project is to develop a set of commercially affordable, effective and interactive DSS for Growers based on site-specific data that allow for an ongoing process of production management refinement and continuous improvement. A Grower would feed in their site specific data into the DSS, based on scope, depth, measurement protocols and frequency rules and record outcomes from such interventions.

It is envisaged that a DSS will be served to Growers through a generic technology platform complete with customised applications and residing on each Grower organisation server. Information collected in each country system would be shared with the system modellers to provide the numbers-of-numbers that are important for proving beta propositions and continual evolvement of the DSS over time.

Subject to the Innovation Partner approach, the project will likely develop the key performance indicators or factors of the biological system and weight their inter-relationship and impact on the mitigation of alternate bearing in avocado at the orchard site level. The Grower will be presented with recommended production management actions or interventions (mitigation strategies) through the DSS that will enable the pro-active management of alternate bearing on that orchard or block.

The DSS will continue to "learn" based on data interpretation, outcomes of production management interventions and inter-seasonal outcomes. A high volume and consistently acquired and specific data (numbers-of-numbers) may be required and the methodology to achieve this will likely be an important cornerstone of the DSS. The beta DSS version would be based on the solution thesis, use current knowledge\science to identify system factors and relationships. Initial DSS users may be a number of selected Growers in parallel across a number of avocado producing countries, representative of the Consortium. The Consortium would expect general Grower DSS users to have early access to the system subject to necessary controls.

Recommended management practice would be developed collaboratively within the project in conjunction with the DSS and extended to growers through each country extension services.

Project Deliverables

1. Identification and characterization of key endogenous components (genes, proteins, metabolites, hormones, etc.) controlling flowering, fruit set and/ or fruit survival.

2. Understanding how fruit load affects the above components

3. Understanding how external conditions (weather, horticultural practices, etc.) affect the above components

GROWER QUESTIONS AND CHALLENGES TO BE ANSWERED BY THE PROJECT

4. How do I influence the ratio of determinant to indeterminant shoots?

5. Can I make my trees less prone to irregular bearing induced by adverse climatic events and how should I respond to such events once they have occurred in terms of tree management?

6. How should I manage my trees (nutrition especially boron and nitrogen, canopy management, cropping pattern, etc) to overcome irregular bearing, both in the on year to promote return crop and in the off year to prevent excessive vegetative growth?

7. The development of practical tools to mitigate AB.

8. Early achievement of optimal and consistent yields during the establishment phase of the orchard (trees <6 years).

9. Consistent inter-seasonal avocado production +\- 20% year-on-year at a commercially sustainable product profile and yield from each of a minimum of 8 nominated orchard areas of > 2 Ha, each having trees > 6 years in the ground in each of 2 geographic locations in each of the Consortium countries in each of 4 successive years production from each orchard area.

10. Decision Support System
    A supported DSS capable of remote data entry by Growers through an interactive, seamless, intuitive, functional and elegant front end with practical applications, potentially including calculators, tools or technologies, delivering customized outputs for Growers via each Consortium web site to their Growers.

RFP – Solutions Partner Capability

The Innovation Partner response to the RFP document will demonstrate the Innovation Partner capabilities in the;

1. detailed knowledge of the phenology of avocado.

2. development and presentation of logical solution hypothesis including a context diagram supported by a detailed descriptions of the component parts

3. a project plan, details of each knowledge gap project and the name and details of the provider, appropriate project structure, systems architecture, proposed milestones, milestone costs and duration, project risks and mitigation strategies.

4. development of an interactive DSS that enables a Grower to feed site-specific data into that system, use tools, calculators and other technologies and receive printed text and graphical outputs to enable the grower to progressively take production management decisions that will reduce or mitigate the alternate bearing of avocado tree\s on their production site.

5. early implementation of Grower and Extension Services engagement as part of the project architecture.

6. formation of a project team with multi-national reach and range within a project architecture reflective, at a minimum, of the Consortium membership; USA, Israel, Australia and New Zealand but subject to the primary aim of engaging with the most capable of global project resources and subject-matter-expertise.

7. development and go-live with a beta version of a DSS with selected Growers by December 2011

RFP Terms & Conditions

THE ARC will offer a Request for Proposal to potential Innovation Partner/s. The following are the Consortium RFP terms and conditions;

1. All work undertaken by a potential Innovation Partner in the preparation of their proposal including any desk-top analysis of current knowledge and the development of a solution hypothesis, all communication with the Consortium or its agent, all demonstrations and presentations, and all other activities involved in preparing, presenting and discussing proposals is at the potential Innovation Partner's cost.

2. Proposal presentations will be required.

3. Any potential Innovation Partner presentations will be held either at;
   Level 1, 8/63 Annerley Road, Woolloongabba, Brisbane Queensland 4120, Australia or ;
   12 Mauchly, Suite L, Irvine, CA 92618-6305 and shall be entirely at the Innovation Partner 's expense.

4. A Innovation Partner's proposal (Schedule C) will be considered as an offer to satisfy the requirements described in this document.

5. Price(s) shown in the proposal will be accurate.

6. Following the Innovation Partner submission, proposals may be varied only with the consent of the Consortium and by agreement between the parties.

7. A joint Innovation Partner proposal, combining the products and services of more than one organisation and across the range of nation states, representative of the Consortium, is encouraged and preference afforded such a project structure.

8. Joint Innovation Partner proposals may only be submitted if one party is identified as the responsible party for Project management and that party is willing to take prime contractor responsibility for all products and services presented in the proposal and the activities of their sub-contractors.

9. All parties to a joint Innovation Partner proposal will be clearly identified and their roles defined.

10. The Innovation Partner shall be responsible for ensuring the suitability of any sub-contractor for the work proposed to be carried out and for ensuring that the work performed by the sub-contractor meets the

requirements, milestones and outcomes of this project.

11. Innovation Partners will submit the CVs of all proposed members of their project team.

12. The Consortium assumes that any Innovation Partner proposal includes everything necessary or usually supplied for the convenient and correct operation of the project solutions proposed, whether it is specified or not. Any deficiencies must be rectified at the Innovation Partner's expense unless otherwise agreed and authorised by the Consortium.

13. Potential Innovation Partners are required to alert the Consortium of any incompatibilities or risks that may occur in the implementation of their proposed solution as part of the proposal.

14. Potential Innovation Partners should request clarification of any matters contained in the RFP that they do not understand or that they believe may be susceptible to more than one interpretation.

15. Requests for supplementary information relating to this RFP will be provided by the Consortium contact person. Responses will be in a timely fashion.

16. The Consortium reserves the right to distribute any supplementary information, with their reply, to all potential Innovation Partners.

17. Any provision of supplementary information will not affect the selection process timetable unless the Consortium, in its sole discretion, deems that an extension to all or any part of the timetable is necessary and, in such event, all potential Innovation Partner\s will receive formal notification of any changes to the timetable.

18. All specifications, prices\costs and other statements contained in the proposal shall remain valid and binding for a period of at least 90 days after the submission of the proposal.

19. All prices\costs must be itemised individually (where possible) and shall include all individual knowledge gap project costs.

20. Prices\costs quoted shall be in USD. The current cross rate to AUD, NZD, ILS shall be stated.

21. Payment terms should allow for a payment schedule to the Innovation Partner based on detailed, measurable and audited milestones.

22. Payments will be made as far as practical within the Consortium member jurisdictions and therefore any project plan should identify the work to be done in each country and by what organisation.

23. It is the undeviating policy of the Consortium to comply strictly with the letter and spirit of all federal, states and applicable international trade regulations and antitrust laws. Any proposed activities of the Innovation Partner that violate these regulations and laws are detrimental to the interests of the Consortium and are unequivocally contrary to Consortium policy and are not acceptable. The Innovation Partner should exercise due diligence in the development of the proposal to assure the Consortium that all compliance issues can be met.

24. No proposal shall be deemed to have been accepted or rejected, until the fact of such acceptance or rejection has been notified in writing to the potential Innovation Partner by the Consortium.

25. The reasons for non-acceptance of any potential Innovation Partner proposal may be disclosed at the sole discretion of the Consortium.

26. Any contract to be executed in respect of supply of the proposed solution will be in a format and terms acceptable to the Consortium.

27. The potential Innovation Partner RFP response will be part of the contract.

28. The potential Innovation Partner will provide client reference sites, names and contacts willing to discuss the performance and capabilities of the potential Innovation Partner or key researchers identified in the RFP response. The Consortium will ask that reference sites provided be as close as possible in industry type or key attributes of the Consortium desired outcomes and demonstrate previous experience of the Innovation Partner.

    Consortium staff may conduct reference site checks. In the first instance this may be by telephone to a number of reference sites. The Consortium may arrange to visit reference sites.

29. The Consortium reserves the right to;
    - use any evaluation method, selection process, and, further, to take any other factors into account which, in the Consortium's sole opinion, will affect the supply, service and support of the project solution, in the selection of an Innovation Partner;

    - reject any and all proposals;

    - accept a proposal that is not the lowest in price;

    - select or reject any specific items identified in a proposal, unless the Innovation Partner specifically states that the item(s) must be taken collectively;

    - enter into negotiations with one or more Innovation Partners to obtain a satisfactory solution if, at the Consortium's sole discretion, none of the proposals are acceptable;

    - enter into negotiations, discussions and refinements with selected Innovation Partner\s to refine and possibly extend the requirements based on the proposals received;

    - request the submission of a variation giving effect to decisions taken as a result of the above discussions. The original proposal plus the variation will be regarded as the final proposal

30. For the purposes of this document, no potential Innovation Partner may consider any representations or statements made by the Consortium personnel or its agents to be an official expression on its behalf; unless such representations are made in a written communication from the Consortium.

31. The potential Innovation Partner shall not make any public statements in relation to this RFP or to the awarding of any contract for the supply of the requested solution without the prior written permission of the Consortium.

32. Any information, data, specifications and other documentation (including this document) relating in any way whatsoever to the activities of the Consortium which have been provided to or obtained by a potential Innovation Partner shall be treated by potential Innovation Partner as confidential, and shall not be disclosed by the potential Innovation Partner, orally or in written or electronic form, to any third party without the Consortium's prior written consent unless such disclosure is to potential project resources.

33. The ownership of all documentation and materials submitted as part of the proposal including diagrams, schematic drawings, photographs, etc. shall pass to the Consortium on the date and time that the proposal is delivered. This clause does not include any information specifically identified by the potential Innovation Partner as "proprietary and confidential".

34. The Innovation Partner will be responsible for arranging and paying for transportation of all materials and documentation. Should the potential Innovation Partner wish to withdraw from the process subsequent to submitting their RFP response, they must advise the Consortium contact person, as soon as possible.

35. All potential Innovation Partner proprietary information contained in the RFP must be clearly identified.

36. The potential Innovation Partner will provide a description and a scope of a support service to operate the DSS for a minimum of five years after the delivery of the project and approximate cost of such a service. The Consortium reserves the right to operate the DSS independently.

37. No legal or other obligations shall arise between the Consortium and the potential Innovation Partner and any party responding (or parties in the case of a joint response) in relation to the conduct or outcome of this RFP process. A legally binding relationship will only ensue upon the signing of a formal written contract document (on terms agreed by the Consortium and the selected Innovation Partner).

38. The Consortium members will each contribute project funds subject at all times to the provisions of and compliance with international financial transaction laws.

    The Consortium will use project funds provided through each Consortium member to meet project liabilities. Funds will be utilised, wherever practical, within a Consortium member jurisdiction for the payment of a Project milestone, or part thereof, as outlined by the Innovation Partner Project plan so as to limit the requirement for the transfer of funds internationally.

39. Each Consortium member will, on behalf of the Consortium, contract Project research and development and other Project services within their tax jurisdiction in their own name as part of the Innovation Partner global research architecture.

For the purpose of making any funds transfers involving different currencies, the amount required shall be converted to U.S. dollars at the average of the buy and sell rates for U.S. dollars of Chase Manhattan Bank, New York, as of the date of the required transfer.

40. For avoidance of doubt the members of the Consortium will co-jointly own all intellectual property developed, discovered or created by the project during the course of undertaking the Project including (but not limited to) any copyright in the Final Report and including knowledge gap project information and the DSS software code, calculators and all elements associated with the DSS operation.

41. The Consortium recognises that individual members of the Innovation Partner project team may wish to publish particular aspects of their work to further their career. Upon a formal request to publish the Consortium will not unreasonably withhold authorisation to an individual to publish.

Expected Project Term

Initial term

An Initial contract term is for a period of three years commencing March 2011 and concluding March 2014. On or before March 2014 the Consortium will conduct a full project review with the contracted Innovation Partner. Subject to the outcome of the review the project will either complete at this time or roll over to the full 5-year term.

Full term

The contract for the delivery of the project will be concluded during December 2016 subject to the outcome of the 2014 review.

RFP Requirements

Submission of Proposals

The closing time and date for receipt by the Consortium of the potential Innovation Partner proposals in response to this document is **5.00 p.m. WST (USA) on February 25 2011**

Notices

Responses are to be sent electronically to the contact person, with any physical proposal collateral sent separately by courier to the Consortium contact address.

Requirements

The proposer will use Schedules C & D as RFP title\section headings in their proposal response and include sufficient detail for ease of understanding.

Information contained in Schedules A & B is for reference only but comments and expansion to these schedules is welcomed by the Consortium as part of an Innovation Partner response.

RFP Evaluation

Potential Innovation Partner proposals will be afforded fair and equal consideration and evaluated, at the Consortium sole discretion, against criteria which may include the following:

- Information contained in the RFP
- Project feasibility and potential of success of the hypothesis and proposed solution
- The quality of the resource mix and geographic range of Innovation Partner resources (network)
- Previous experience and reference site information
- Cost
- Risk
- Terms of Trade
- Value

The Consortium will decide on a shortlist of potential Innovation Partners. The shortlisted proposers may be invited to make a presentation to the Consortium.

Contract

Following completion of a successful RFP process the selected Innovation Partner will meet the Consortium to confirm project scope & cost **by March 31, 2011**

During April the Consortium will work with the successful Innovation Partner to develop the suite of contracts in each jurisdiction. The standard Innovation Partner contracts in each jurisdiction may be acceptable to the Consortium or require agreed amendments.

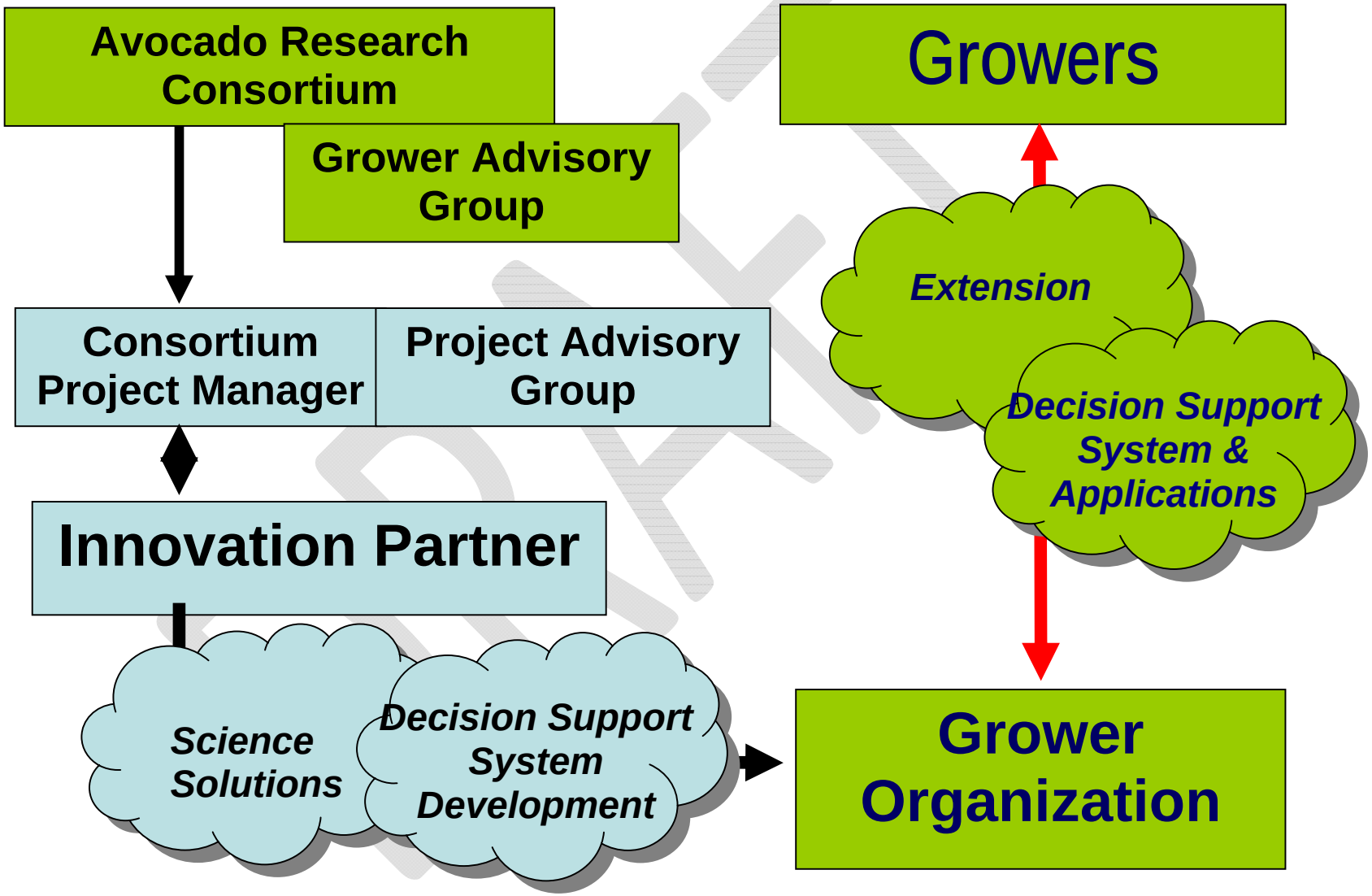
RFP Timetable

The indicative timetable for the Innovation Partner \s selection process is as follows:

Element	Attribute		Due date
RFP	Issue document to potential Innovation Partner/s	(Stage I)	December 24, 2010
	Proposed Innovation Partner RFP responses due		February 25, 2011
	Reference site contacts		March 4, 2011
	Proposal review		March 11, 2011
	Establish Shortlist		March 15, 2011
Proposed Innovation Partner	Innovation Partner presentations	(Stage II)	March 25, 2011
	Preferred Innovation Partner \s selection	(Stage III)	March 29, 2011
	Meeting - Confirmation of project scope & cost		March 31, 2011
	Innovation Partner contract/s		April 2011

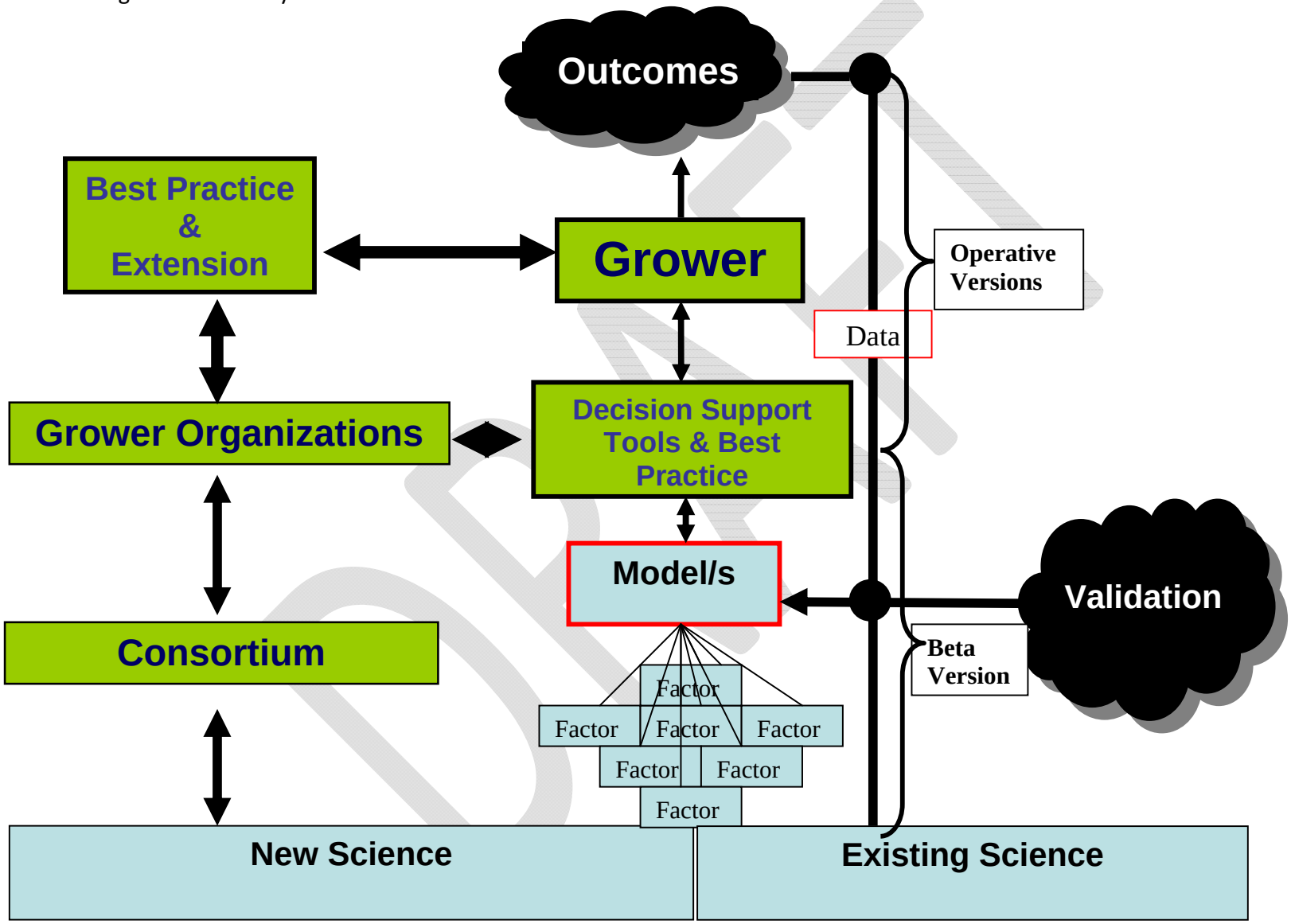
SCHEDULE A AVOCADO RESEARCH CONSORTIUM – SUMMARY PROJECT ARCHITECTURE

The following is the summary project architecture.



SCHEDULE B CONTEXT DIAGRAM – INDICATIVE SYSTEM ARCHITECTURE

The following an indicative system architecture.



SCHEDULE C RFP REQUIREMENTS

Innovation Partner Proposal
The RFP response by the potential Innovation Partner should be from the Innovation Partner project manager. Innovation Partners are required to submit proposals in following content title order:

a. Innovation Partner name & contact details
    i. Key contact name
    ii. Contact details

b. Hypothesis \ solution
    i. A feasible and plausible hypothesis
    ii. Summarise the reasons why the hypothesis will provide a solution to alternate bearing

c. Project approach
    i. Project approach and method
    ii. Project organisational architecture schematic
        a. where more than one project party is involved the response should explicitly state that the Innovation Partner accepts that role and explains its relationship with other sub-contractors.
    iii. Proposed network of collaborative sub-contractors; science, systems, technicians
    iv. Indicative location and number of Growers participating in the beta-version of the DSS
    v. Project resources - HR CVs
    vi. Project reporting - describe scope, depth and frequency and form
    vii. Other

d. Schedules

No.	Project Milestone	Detailed Milestone Description	Start Date	Finish Date

No.	Project Milestone	Provider Party (Name, Location)	Detail and Estimated Effort (person days)	Cost\day	Cost x Milestone

e. Solution
    i. Discuss the components of the hypothesis and why they are integral to the solution
    ii. Biological system factors\influences that will feature in the decision support system

f. Decision Support system feasibility
    i. Systems solution architecture overview - description and context diagram
    ii. Summary functional and system specifications - hardware and software & system architecture schematic
    iii. User functionality – describe what a Grower will do and what the system will present to the Grower
    iv. System testing procedures
    v. Post Go-Live - description of services & user\system support architecture schematic

g. Description of project outcomes for the Grower
    i. A description of the outcomes and at what point these will arise within the project

h. Quality assurance and risk management process
    i. Project constraints
    ii. Issues & issues resolution
    iii. Risk assumptions and risk mitigation
    iv. QA – summarise critical control points and assurance approach

i. Rights
    i. The Innovation Partner will explicitly identify all information provided to the Consortium as part of the RFP, any software, and the project process subject to any software licensing, copyright, or other legal restrictions
    ii. The Innovation Partner will explicitly identify their rights with respect to any intellectual property/ know how

j. Previous experience
    i. Alternate bearing in fruit crops
    ii. Detail the experience in biological decision support systems development and any aligned experience
    iii. Past performance

k. Reference sites
    i. Entity name
    ii. Contact details
    iii. Reason for use as a reference site – scope

l. Expected requirements and accountabilities of the Consortium
    i. Project meetings, frequency & location
    ii. Contracts
    iii. Terms of trade - milestone payments & currency
    iv. Other

m. Appendices
    i. The Innovation Partner may provide supplementary evidence of capability in addition to elements above.

SCHEDULE D KNOWLEDGE GAP PROJECTS

The project is likely to require a number of sub-projects to integrate existing knowledge and fill knowledge gaps that support the development of a robust decision support system. The Innovation Partner will complete knowledge gap projects in years 1-3 and also identify those sub-projects that will extend further than year 3 (2013).

A formal presentation of each project proposal and how that project integrates with a solution will be required as part of any presentation in response to the RFP.

Project Title:

Existing Knowledge /Knowledge Gap Project Title:

Reason and justification for inclusion as a knowledge gap:

Key Attributes of the Knowledge Gap Project:

Context Diagram - to show linkage to the core solution and decision support system:

Expected outcome\s:

Summary project milestones, description, timeline:

Summary of effort duration to complete (person days):

Cost (USD) by milestone and location of project elements (country):

Project human resources and suppliers\collaborators (if identified):

Project organisational (resources) architecture schematic:

Note:
New knowledge gap projects may arise during the course of the project and will be a scope change to the project. A separate project justification will be required for any scope change. Scope changes may be agreed by the Consortium at their sole discretion.

International Alternate Bearing Research Summitt
Invitee List

Name		Country	Main expertise	Secondary expertise
Researcher				
Schaffer	Bruce	USA	Tropical fruits	Ecophysiology
DeJong	Ted	USA	Partitioning	L systems
Mickelbart	Mike	USA	Avocado physiology	Stress response
Rosenstock	Todd	USA	Nut crops	
Ferguson	Louise	USA	Olives	
Arpaia	Mary Lu	USA	Tree management	Fruit and tree physiology
Brown	Patrick	USA	Nutrition/Boron	Precision Farming
Lovatt	Carol	USA	Plant Growth Regulators	Flowering
Smith	Harley	USA	Molecular Biology	Flowering
Rosecrance	Rich	USA	Nut crops and Avocados	Nutrition
Hormaza	Iñaki	Spain	Flowering	Pollination
Cuevas	Julian	Spain	Alternate bearing	Olives
Köhne	Stefan	South Africa	Industry	Productivity
Bower	John	South Africa	Fruit growth and development	Fruit physiology
Steyn	Wiehann	South Africa		
Leonardi	John	Australia	Tree management	
Wilkies	John	Australia	Flowering	
Hanke	Viola	Germany	Genetics of flowering	
Sadka	Avi	Israel	Citrus	Flowering
Irihimovitch	Vered	Israel	Molecular biology	Fruit growth and development
Ish-Am	Gad	Israel	Flowering & pollination	Management
Samach	Alon	Israel	Molecular biology	Flowering
Gafni	Udi	Israel		
Gardiazabal	Francisco	Chile	Tree management	Nutrition
Gil Montenegro	Pilar	Chile	Fruit tree physiology	Water Relations

International Alternate Bearing Research Summitt
Invitee List

Magdahl	Christian	Chile	Tree management	Growing systems
Mena	Francisco	Chile	Tree management	Growing systems
Ferreyra Espada	Raul	Chile		
Ricardo	Cautin	Chile	Tree management	Growing systems
Barrientos-Priego	Alejandro	México	Germplasm, Genetics	Tree management
Salazar-García	Samuel	México	Flowering	Tree management
Goodwin	Mark	New Zealand	Pollination	
Kelly	Dave	New Zealand	Masting	
Minchin	Peter	New Zealand	Phloem transport	Carbohydrate partitioning
Thorp	Grant	New Zealand	Fruit tree physiology	Tree management
Industry support/management				
Allen	Antony	Australia	CEO, AAL	
Donkin	Derek	South Africa	CEO, SAAGA	
Bellamore	Tom	USA	CEO, CAC	
Dixon	Jonathan	USA	CAC	
Aymami	April	USA	CAC	
Hanson	Angie	USA	CAC	
Ryan	Dan	New Zealand	Plant and Food	
Thorn	Alan	New Zealand	CEO, AIC	
King	Hugh	New Zealand	AIC	
Pak	Henry	New Zealand	AIC	Plant physiology
Burrell	Mark	USA	Westmark	