Know-how for Horticulture™

A crop management service to promote new technology for sweet corn in Central West NSW

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Simplot Australia Pty Ltd

Project Number: VG01078

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This report is published by Horticulture Australia Ltd to pass on information concerning horticultural research and development undertaken for the vegetable industry.

The research contained in this report was funded by Horticulture Australia Ltd with the financial support of Simplot Harvesters.

ISBN 0 7341 1135 5

Published and distributed by:
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HAL

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HAL Project Number	VG01078 (30 May, 2004)
Project Title	A crop management service to promote new technology for sweet corn in Central West N.S.W.
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Research Provider	Simplot Australia

HAL Project Number VG01078

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Purpose of the report To summarise the activities and outcomes of the Sweet Corn Management Service (SCMS), a technology transfer project conducted over three years (2001 – 2004) in Central N.S.W.

Acknowledgment Project VG01078 was conducted with the financial support of Horticulture Australia Ltd., Simplot Australia Pty. Ltd., and the processing sweet corn growers of Central West N.S.W.

Horticulture Australia

Simplot AUSTRALIA

Sweet Corn Growers of Central West N.S.W.

Date of the report June, 2005

Media Summary

The processing sweet corn industry in Central West NSW has struggled with the effects of drought and increasing disease pressure. The crop management service (SCMS) was developed to promote and enable the rapid adoption of new technology to gain a competitive edge.

SCMS has assisted growers with new technology to address tight profit margins, the spread of new plant diseases and rising community expectations for the environment. SCMS is an exciting concept in two important areas:
1. It provides growers with a level of ownership and control of the process to find, assess and adopt new technology.
2. It has forged a close link between growers and processor. This has been important for the understanding of shared challenges.

The development and management of SCMS has been driven by a steering committee, with grower and processor members. Grower support has exceeded expectations and almost 100% of the sweet corn area participated. SCMS was funded through a Voluntary Contribution project between Simplot and its sweet corn growers, and HAL.

The service has been scrutinised by the stakeholders to ensure that it maintains value for money and provided strong benefits. Key outcomes include:
- Improved consistency of corn quality, with reduced rejection.
- More efficient production from better use of pesticides, fertiliser and water.
- Improved factory efficiency.
- More reliable supply of raw product to the factory.

The agronomist has been a key to the success of the service. SCMS was very fortunate in securing Chris Russell, an experienced vegetable agronomist, for this role. Similar services should not proceed without the services of an outstanding agronomist.

Growers now routinely use proven technology, such as plant tissue analysis and electronic soil moisture probes. SCMS has maintained a research and development component to seek new, improved technology. New areas for future research have been identified by SCMS; including, soil compaction, better fertiliser strategies, aerial imagery and precision farming.

SCMS has accelerated the process of change and has shown worthwhile benefits to all stakeholders.

Introduction

Processed sweet corn is traded internationally, free of the quarantine and short shelf life issues of fresh corn. The processing sweet corn industry in Australian must be highly competitive to maintain or grow market share and survive against the threat of increasing imports. There is an opportunity to strengthen the competitiveness of the industry through the adoption of new technology for sweet corn production, leading to an improvement in the efficiency of raw sweet corn supply and a reduction in the chance of crop defects or rejection.

The cost of rejection, whether caused by poor irrigation, nutrition or pest and disease management, has a strong effect on the processor as well as the grower, undermining the viability of the whole industry. In recent years, losses from insects, kernel set, water stress and leaf diseases have been severe at times. Some of these losses may be unavoidable (e.g. severe weather and drought); however improved approaches to crop management decisions would reduce the chances of losses in the future.

Significant advances have been made recently in the technologies for irrigation scheduling, plant nutrition strategies and integrated pest and disease management.

These new technologies rely heavily on the supply of timely information about the crop. For instance new IPM strategies for sweet corn (VG 97036, "Insect Pest Management in Sweet Corn"), relies on formal scouting strategies to aid pest management decision-making. Prior to 2001 the majority of processing sweet corn growers in the Central West of NSW did not use soil moisture monitoring equipment, plant tissue testing or trained crop scouts to regularly assess pest and disease populations in their crops. Without this important information, crop management can be well below best practice. In particular insect control measures are often applied late, with expensive rejection rates.

This main aim of the project was to provide a mechanism for the widespread adoption of the new technology. The planned outcomes were:

- Increase the farm gate yield by 8%.
- Improve corn quality, reduce rejection rates by 4%.
- Improve field production efficiency and reduce environmental impact through better (more timely) use of inputs such as chemicals, fertilizer and water. Reduce growing costs by 5%.
- Improved factory efficiency through increased quality, reliability and reduced interstate imports. Processing recovery increased by 1.5%.
- Promote a unique partnership of processor and grower.

This project was designed to provide a crop management service, based on new technologies, to sweet corn growers in the Central West of NSW. It used, and built, new information from recent HAL projects (VG 97036 & VG 227). The service was based on an agronomist and seasonal staff to provide irrigation scheduling, plant nutrition and pest and disease modules. The aim was to develop a self-sustaining entity for the long-term benefit of the industry.

Technology transfer strategy and methodology/activities

The development of SCMS was based on the provision of an integrated crop management service for sweet corn growers in Central West New South Wales. SCMS differs from the range of services available to the sweet corn growers, in that it is a complete crop management service that is tailored to the specific needs of processing sweet corn production for each individual grower.

SCMS has a modular structure. This allows:

- Division of crop management into a series of interacting technical parts.
- The clients to choose technical areas most relevant to their needs.
- The tailoring of the service provided to suit client needs and budgets.

Four core modules have been identified in discussion with experienced growers and Simplot Field Service Officers:

- Plant Nutrition Strategy
- Pest and Disease Management
- Irrigation Scheduling
- Pre-plant Planning

These core modules have a synergistic effect when applied together in the field, and are presented as the basic package. Efficiencies in service delivery also result when these modules are supplied as one package. Additional (optional) modules may be developed in the future according to industry demand.

Initially SCMS will achieve the specific objectives outlined in 2.4 by providing a skilled Agronomist, experienced Field Officers and a Scout to work with growers one-to-one to improve crop management decisions made for plant nutrition, irrigation and pests and diseases.

The details of the core modules are:

(I) Plant Nutrition

- Pre-plant soil analysis – at least P, K, N, Cu, Zn, Mn, Fe, pH, salinity, organic carbon.
- Soil analysis report, interpretation and advice.
- Pre-plant discussion between grower and agronomist to plan the fertiliser strategy.
- A minimum of 3 plant tissue samples per crop for macro and micro element analysis.
- Plant tissue and soil analysis reports, interpretation and advice.
- End of year summary of plant nutrition, with notes on changes for future fertiliser programs.

(II) Crop monitoring

- Pre-plant discussion of paddock history to assist with planning weed, pest and disease control.
- Twice weekly inspection for crop health, cob development and quality, pests, diseases and weeds.
- Detailed monitoring report produced 'on the spot'.
- Professional plant pathology and entomology back-up when needed.
- End of year summary, including reports on yield, quality, weed, pest and disease levels, comparisons with district averages, and notes on implications for future crop management programs.

(III) Irrigation scheduling

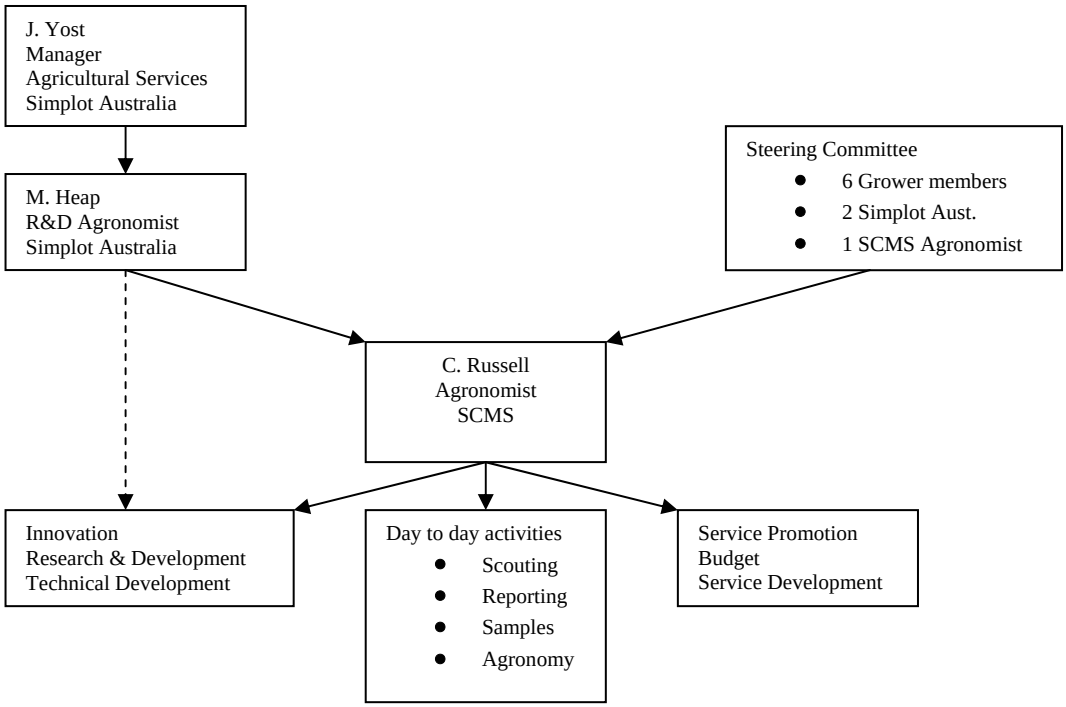
- Pre-plant discussion to assist with the general approach for crop irrigation and to examine the capability of the irrigation plant.

- Installation of electronic soil moisture probes. Capacitance technology with data logging.
- Regular visits to discuss soil moisture results.
- End of year summary of irrigation operations, including graphs showing the amount and timing of water applied, seasonal soil moisture levels, and notes on implications for future irrigation management.

(IV) Pre-plant planning

A formal discussion session between the grower and agronomist is used to develop an overall strategy for key crop management operations. This strategy is not be a "general recipe for growing sweet corn"; it is tailored to the individual needs of each enterprise and will represent the intentions of the grower. The output is simple, practical, and presents the details and timing of the key crop management operations on one page.

The structure of SCMS was set up to ensure that the sweet corn growers (clients) had a strong voice and a role in the technical and business development of the service. The steering committee was an outstanding success in this role. The diagram below shows the structure for 2001 – 2004.



SCMS used the staff and infrastructure of Simplot Australia:

Staff	Office/Location	Major Equipment	Notes
Agronomist	Bathurst	Car/mobile phone/computer	Full time 2002-2004 60% 2005 onwards
2 Field Officers	Bathurst field office *	Car/mobile phone	30% time each
Scout	Dubbo/Home	Car/mobile phone	Casual/seasonal
Secretary	Bathurst field office *	Computer	10% of time
R&D Agronomist	Simplot Kensington	Car/mobile phone/computer	10% of time

* Simplot field office with computer, fax, photocopier etc.

The ongoing identification, development and adoption of new technology is the life-blood of SCMS. Service development has been the day-to-day responsibility of the Agronomist, with assistance from the R&D Agronomist. The Steering Committee has overseen the general direction of service development, setting priorities for the future. The Steering Committee held 3 meetings a year, and performed well as the voice of industry.

Technology transfer was the constant focus of SCMS. In addition to constant (weekly) contact with growers, the Agronomists have conducted annual field days at Bathurst and conducted 3 major workshops for growers in each year to discuss SCMS technology and data. All growers received large colour reports for each crop, in each year. One-on-one meetings were held annually with an agronomist to discuss the implications of the crop report.

The Steering Committee and Agronomists have, at times, initiated research to develop new technology for local issues. This has included several demonstrations of seed establishment technology.

Some significant technical insights came from the analysis of the collective SCMS database. These include:

- A large reduction in the amount of nitrogen applied to sweet corn crops – 200 kg N/ha average in 2001-02, reducing to 106 kg N/ha average in 2003-04. In some cases growers have reduced total N application by 70%.
- Insecticide use has been reduced in line with fertiliser rates, with some growers not even applying biological or traditional chemical products for Heliothis control.
- Monitoring soil moisture and modifying irrigation strategies produced higher yields for individuals.

Evaluation and measurement of outcomes - impact and adoption

Sweet corn yield and reject levels in Central NSW from Simplot Bathurst Field Service:

		Season Notes	Field Yield Mean	Non-Trash Rejection (%) Mean		
			t/ha	Insect	Pollination	Total Reject
Pre-SCMS	1999-00	Normal	15.8	6.8	3.8	12.3
Pre-SCMS	2000-01	Normal	14.9	4.5	3.8	9.1
Year 1	**2001-02**	**Normal**	**15.0**	**2.7**	**1.4**	**6.0**
Year 2	**2002-03**	**Drought/hot**	**14.9**	**3.4**	**1.1**	**7.0**
Year 3	**2003-04**	**Drought/hot**	**14.9**	**3.4**	**1.1**	**7.4**
Post-SCMS	**2004-05**	**Normal**	**17.5**	**2.5**	**0.9**	**6.1**

Records of grower inputs also show a large shift in fertiliser strategy as a result of the service. Nitrogen applied as fertiliser per hectare fell by 30% overall. The years 2001-02 to 2004-05 saw a reduction in the use of traditional chemical pesticides and the employment of a rational mix of biological and chemical options. The SCMS Scouting allowed growers to use less sprays overall (1.5 less per crop on average) as they reduced the practice of 'insurance spraying'.

Despite the two tough drought years encountered, the support from growers for SCMS remained strong, and confidence in the industry continued.

Discussion

Yield improvements were significant for individuals, but an upward trend was could not be argued for the whole of industry. Several issues had an impact on the industry over the SCMS period that contributed to its apparent failure to meet the yield increase target of 8%:

- Severe drought gripped most of NSW for 2002-03 and 2003-04 (the 2nd and 3rd SCMS years), testing the irrigation capacity of systems needing some summer rain to "top-up" soil moisture levels. The data from SCMS helped growers to see the deficiencies of their irrigation systems and to quantify the financial losses.
- The drought forced traditional production from favoured sweet corn districts to new areas, presenting problems not previously encountered.
- Several experienced, high yielding growers ceased sweet corn production after 2001-02 (the first SCMS year), as water became a valuable and saleable commodity in traditional districts.
- A new disease problem (*Fusarium*) in 2002-03 resulted in 6,000 tonnes of sweet corn being un-suitable for processing. This area was deducted from the table.

The drought and heat of the 2002/03 and 2003/04 seasons had a large impact on yield. It may be argued that the 2004/05 season (normal) was a demonstration of the progress made by SCMS, with an average yield of 17.5 t/ha, comparing favourably against the pre-SCMS yields of 15.8 t/ha and 14.9 t/ha in the normal seasons of 1999/00 and 2000/01.

The target for improved quality of sweet corn supplied to the factory was for a reduction of 4% in the average rate of rejections at the factory intake. The downward trend for reduced insect damage, poor pollination and total rejection rates indicate that this objective was exceeded.

The project made a strong impact on the attitude of the sweet corn growers of Central West NSW. The value of the closer working relationship was high, as the processor and the growers battled through three very tough years. The cost of gaining supply could have been much higher without the relationship and information sharing aspects of SCMS.

The influence of SCMS on grower attitudes is still evident. As a group, the growers are more active than in the past at pursuing new technology. Two-thirds of the growers now own and operate electronic soil moisture monitoring equipment, and several have purchased additional equipment for 2004-05. The routine use of soil tests and plant tissue analysis is now widespread and the value of scouting to make better pest management decisions is appreciated.

Growers have used the analysis of SCMS data from all of the crops combined as a research tool. Several grower initiated ideas and demonstrations have emerged from this approach. Trials of soaking sweet corn seed in water prior to planting (chitting) have produced improvements in uniformity of emergence and planter spacing. Grower interest in this technique has lead to several more trials for the 2004-05 season. Growers and seed companies have also begun work to examine new generation seed coating technology for better crop establishment.

Many myths about sweet corn production were dispelled by providing growers with information on their own performance compared with the district and industry averages (eg. irrigation timing and quantity). Some of the myths relate to very high rates of pre-plant and planting nitrogen and also the poor maintenance of soil moisture during early plant growth.

The Simplot farming operation in Bathurst has served to demonstrate fertiliser and irrigation principles to the wider growing community. An annual field day connected to SCMS has

allowed growers the chance to inspect new varieties, and the results of different fertiliser practices.

The actual financial impact of SCMS is difficult to assess. Our best estimate (per year) for the grower benefit alone @ 35,000 t sanction (2,200 ha) is:

Item	Benefit	Source of benefit	
Reduced rejection	Grower	$12/t bonus	$420k
Reduced N fertilser	Grower	30% less N fertiliser bought $220/ha x 0.3	$145k
Reduced insecticide	Grower	1.5 less sprays per crop $60/ha x 1.5	$198k
Yield	Grower	?	?
Better operating efficiency from less defects	Factory	Less waste, faster throughput	$300k
Annual Total		Grower	$1,063k

Although the actual source of the benefit has changed, this benefit compares favourably with the projections at the start of the project, where an annual impact of $1,074k was presented. It is possible that the yield trend for normal years will establish a significant contribution from this item.

Project projection – made in 2000, attached to the HAL application:

Year		01_02	02_03	03_04	04_05	05_06	06_07	07_08	08_09	09_10	10_11	
Benefit	Influence	50% ind.	60% ind.	75% ind.	75% ind.	75% ind.	75% ind.	75% ind.	75% ind.	75% ind.	75% ind.	
	Tonnes k	18	21	26	26	26	26	26	26	26	26	
					Benefit	$k						
Yield	8%	189	227	284	284	284	284	284	284	284	284	
Reject	4%	95	113	142	142	142	142	142	142	142	142	
Efficiency	5%	118	142	178	178	178	178	178	178	178	178	
Proc. recov.		313	376	470	470	470	470	470	470	470	470	
												Total
Total NSW	benefit	715	858	1,074	1,074	1,074	1,074	1,074	1,074	1,074	1,074	**$10.1m**
Disc @	8%	715	794	919	850	786	727	672	622	575	532	**$7.2m**

Process recovery - 1% reduction in reject = $138,000

estimated average annual value of reduced need to access corn from Qld = $75,000

This annual return does not take into account the intangible benefits such as smaller environmental footprint, reliable supply, and better relationship within the industry.

Recommendations

The analysis of SCMS databases revealed several areas of potential future research:

- Soil structure and compaction and its influence on yield.
- Refined fertiliser strategies to increase yield and reduce insect pressure.
- Aerial imagery to:
    - Pin-point problem areas (disease, nutrition and irrigation) in large paddocks.
    - Estimate yield and maturity.
    - Promote variable rate farming technology

Agricultural Service providers in Central West NSW were exposed to new crop monitoring ideas, with scouting being routinely performed by an external consultant in 2003-04 in two districts. Growers have formed lasting commercial arrangements with service providers as a direct consequence of SCMS. The use of external consultant crop scouting continues, however, the cost per grower has increased significantly as the project has changed in nature, post HAL. This may erode the use of consultants for scouting in the future, risking a return of insurance insecticide applications in its place.

Acknowledgments

Great thanks go to the Sweet Corn Growers of Central West NSW for their faith, persistence and contribution. A special thanks to George Smith and Jeff McSpedden and the other growers who contributed so much through the Steering Committee.

Well done to Chris Russell, who performed at an exceptional level and did the extra miles needed.

Thanks to Simplot Australia, who invested significant resources (people and money) into the future of the industry in their support of SCMS.

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