Know-how for Horticulture™

Irrigation management of processing tomatoes

VG047

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NSW Agriculture

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Australian Processing Tomato Research Committee

NON TECHNICAL SUMMARY

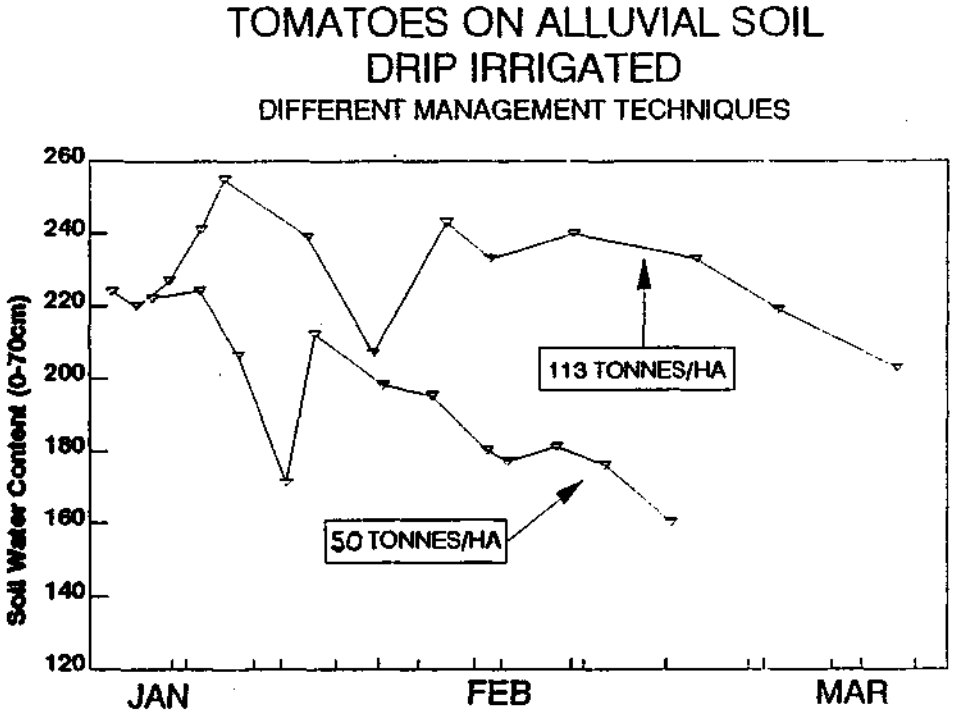
The average yields of Lachlan Valley Processing tomato growers is less than 50 tonnes/ha.

Monitoring the water use of the tomato crops using a Neutron Probe (and Water Watch) has shown that by understanding soil moisture, crop water use (evapotranspiration), and responding accordingly, growers are able to increase yields by as much as 100%.

As a result of the success of the co-operative extension program scheduling of all Valley tomato crops (with one exception) was undertaken during the 91/92 season using Neutron Probes.

BACKGROUND

Monitoring of the soil status of tomato crops in the Lachlan Valley during the 1988/89 & 1989/90 season revealed that there was a general trend to have soil moisture levels much drier than necessary to achieve high yields. Average yields were, most cases less than 50 t/ha. The following graph illustrates the effect of seasonal soil water content in the root zone on total payable yield for the 1988/89 season. (1990/91 season's superimposed)



Growers felt that better irrigation management was the key to improving yields and quality. But management points such as: the depth of water infiltration following irrigation, depth from which water was being extracted by the crop and the current available soil water status had not been explored particularity in an on-form, broadacre situation.

PROJECT

To undertake a co-operative extension program dealing with irrigation management of processing Tomatoes.

OVERALL OBJECTIVES

1. To increase the yields and quality of processing tomatoes by better irrigation management.

2. To develop strategies for scheduling irrigations on furrow, overhead spray and drip irrigation systems in an on farm (broad acre) situation, given that the basic research has been carried out (R Hermus, Yanco) by assessing the practicality of using modern irrigation scheduling aids.

WORK PERFORMED

Eight Neutron Probe sites, were established over three fields covering 46 hectares of processing tomatoes on the properties of Sally & Robert Caldwell.

Two sites were on river alluvial soil, one on a drip irrigation block, the other on a side roll sprinkler irrigation block with the remaining six sites on a red levee type soil. Irrigation of this red soil was by furrows on traditional tomato beds supplemented by hand move sprinklers.

Each site was monitored with a direct reading Neutron Probe supplied by LIRAC Inc. Measurements were also taken of petiole sap nitrogen, plant height and plant width. This data was downloaded onto a computer running software developed by Neutron Probe Services Pty Ltd.

"WaterWatch", a weather based, was used in conjunction with the soil based neutron probe system by incorporating the WaterWatch figures into 'The Probe' spreadsheet software.

The landholders were supplied with regular print outs from the software outlining the current soil moisture status and estimated future water use. His decisions on when to irrigate were based on the accumulated information.

RESULTS

It was demonstrated that yields can be significantly increased by the manager having a greater understanding of soil - plant - water relations.

Preliminary findings indicate a direct relationship between high yields and high moisture availability in the soil. The irrigation scheduling aids used allowed the grower to get a much better understanding of the changes in soil moisture and hence the need for accurate scheduling of irrigations.

The following table is a summary of the net payable yields obtained

TABLE 1: Nett payable yields for selected sites on each soil type.

	RIVER ALLUVIAL		RED SOIL		
	BLOCK 9	BLOCK 8	BLOCK 1	BLOCK 4	BLOCK 7
VARIETY	ALTA	UC82B	UC82B	UC82B	UC82B
	DRIP	SPRINKLER	FURROW / HAND MOVE SPRINKLER		
AREA (HA)	3.7	3.1	5.6	5.4	6.4
NETT PAYABLE YIELD	423.0	314.6	211.6	276.8	376.4
NPY / HA	113.4	98.6	37.3	51.3	59.2

OVERALL — ALLUVIAL SOIL	OVERALL — RED SOIL
TOTAL AREA ——— 6.9 HA	TOTAL AREA ——— 38.9 HA
TOTAL YIELD ——— 737.6 TONNE	TOTAL YIELD ——— 1944.5 TONNE
AVERAGE ——— 106.6 T/HA	AVERAGE ——— 50 T/HA

As shown the yields ranged from 37 t/ha to 113 t/ha. The lowest yield was on a red soil furrow/sprinkler irrigation block where there was a problem providing sufficient sprinkler shifts after it was discovered that water delivered by the furrows was not contributing to the increase in soil moisture status. By contrast the highest yields was on a deep alluvial soil with drip irrigation.

The three graphs in Figure 3 illustrate the effect of the seasonal water content in the root zone on total nett payable yield. The block that yielded only 37 t/ha (Graph A) was the driest throughout the season while the middle block (Graph B) had large fluctuations in soil moisture. The highest yielding block (Graph C) had constantly higher soil moisture throughout the season.

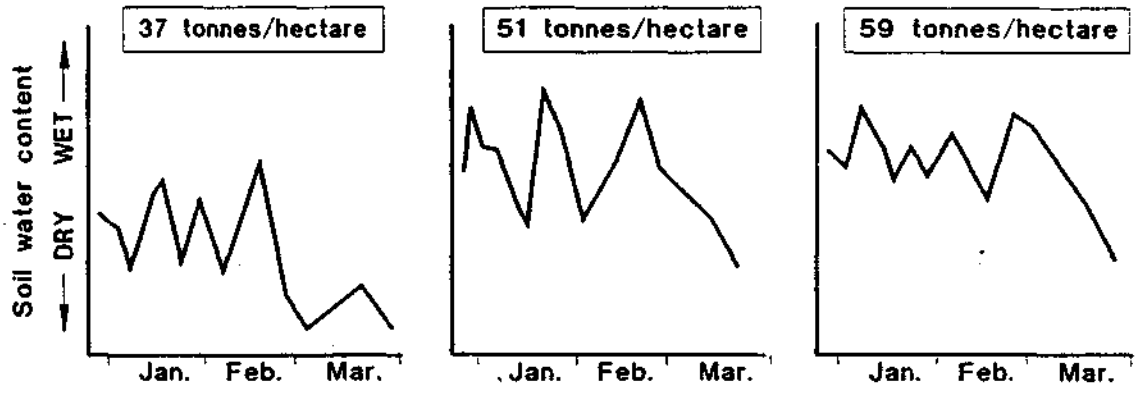


Figure 3.
The effect of irrigation management on payable yield.
These soil water 'time graphs' are from three commercial blocks, red levee soil, furrow irrigation supplemented with hand move sprinkler irrigation

EXTENSION ACTIVITIES

Results of the co-operative extension program were presented to Lachlan Valley Growers at a Workshop at Cowra on 6 August, 1991 and to Southern NSW and Victorian Growers at a Seminar at Darlington Point on 30 January, 1992.

A field day was also held at Cowra on 24 January, 1992.

PAPERS ARISING FROM THE PROJECT

Articles have been prepared for the Australian Processing Tomato Growers (Vol 12, July 91) and the Lachlan Valley - Irrigators Newsletter (Vol 3, No 2, November 91). Copies of the articles are attached at Appendix A.

DEVELOPMENTS EMULATING FROM THE PROJECT

In the seasion just completed (91/92), as a direct result of this project, the following occurred:

1. Edgells, Cowra initiated a scheduling/monitoring service to their contracted growers using a Neutron Probe. Each farm had two sites, one scheduled the other not, to indicate to growers the difference in the types of irrigation management. Trials were also conducted into the placement of site tubes on beds.

2. Drews Rural Service, Cowra commenced a scheduling service for 4 tomato growers using their Neutron Probe.

3. A continuation of this project was carried cut in Co-operation with Mr Robert Caldwell.

The above "services" were carried out in conjunction with NSW Agriculture, and all data obtained is currently being analysed.

Ian Smith and Barry Swann are Officers with NSW Agriculture

Irrigation management of processing tomatoes

A farm scale project on practical irrigation management of processing tomatoes was conducted during the 1990/91 season in the Lachlan Valley of NSW. The aim was to assess the practicality of using irrigation scheduling aids for processing tomatoes.

BACKGROUND

Monitoring of the soil water status of tomato crops in the Lachlan Valley during the 1989/90 season revealed that there was a general trend to have soil moisture levels much drier than necessary to achieve high yields.

Growers felt that better irrigation management was the key to improving yields and quality. But management points such as; the depth of water infiltration following irrigation, depth from which water was being extracted by the crop and the current available soil water status had not been explored.

The basic research on crop water use of tomatoes has been done and reported previously by Rita Hermus (Aust. Processing Tomato Grower, Vols 6, 7, 8, 1985-87).

In the 1990/91 season a co-operative project was developed between Mr. Robert Caldwell, processing tomato grower and Ian Smith, Irrigation Officer with NSW Agriculture.

WORK PERFORMED

Eight sites, consisting of three neutron probe access tubes each, were established over three fields covering 46 hectares of processing tomatoes.

Two sites were on river alluvial soil, one on a drip irrigation block, the other on a side roll sprinkler irrigation block. The remaining six sites were on a red levee type soil about one kilometre from the river. Irrigation of this red soil was by furrows on traditional tomato beds supplemented by hand move sprinklers.

Each site was monitored with a direct reading neutron probe throughout the season to a depth of 120cm. Measurements were also taken of petiole sap nitrate, plant height and plant width. This data was downloaded onto a computer, running software developed by Neutron Probe Services P/L.

'Water Watch', a weather based irrigation scheduling information service operated by NSW Agriculture, was used in conjunction with the soil based neutron probe system by incorporating the Water Watch figures into 'The Probe' spreadsheet.

Robert Caldwell was supplied with regular printouts from the software outlining the soil moisture status. His decisions on when to irrigate were based on the accumulated information.

Table 1 is a summary of the nett payable yields obtained.

It was demonstrated that yields can be significantly increased by the manager having a sound understanding of soil plant water relations.

Preliminary findings indicate a direct relationship to high yield and high moisture availability in the soil. The irrigation scheduling aids used allowed the grower to get a much better understanding of the changes in soil moisture

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and hence the need for accurate scheduling of irrigations.

As shown the yields ranged from 37 tonnes per hectare to 113 tonnes per hectare. The lowest yield was on a red soil furrow/sprinkler irrigated block where there was a problem providing sufficient sprinkler shifts. By contrast the highest yield was on a deep alluvial soil with drip irrigation.

The pair of neutron probe depth graphs (Figures 1 and 2) illustrate the moisture profile under furrow/sprinkler irrigation on the red soil and sprinkler irrigation on the alluvial soil. It can be seen that the plants used water to a much greater depth on the deep alluvial soil (Fig. 2) than on the red levee soil (Fig. 1).

The three graphs in Figure 3 illustrate the effect of the seasonal soil water content in the root zone on total payable yield. The block that yielded only 37 t/ha (Fig. 3A) was the driest throughout the season while the middle yielding block (Fig. 3B) had large fluctuations in soil moisture. The highest yielding block (Fig. 3C) had constantly higher soil moisture throughout the season.

FIGURE 1: Soil moisture 'depth graph', red levee soil, furrow/hand move sprinkler irrigation.

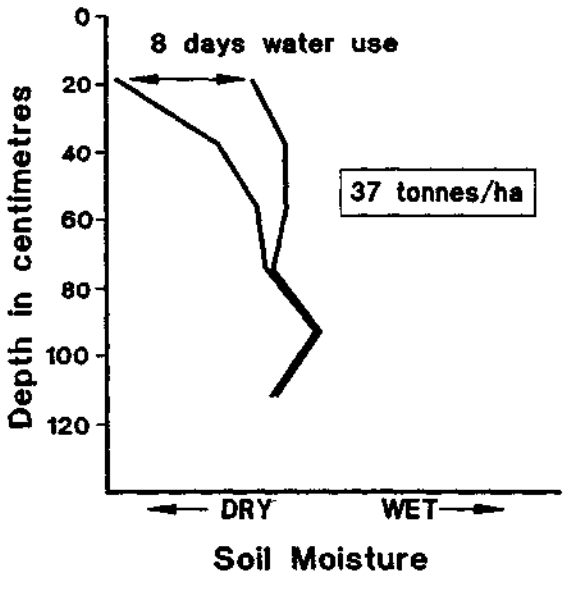
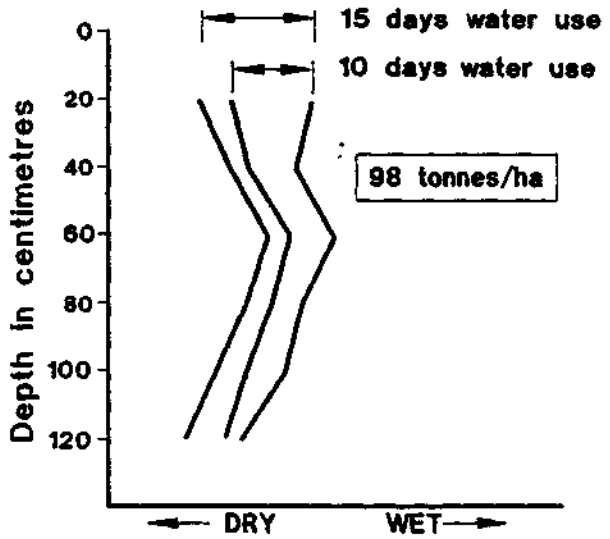


FIGURE 2: Soil moisture 'depth graph', river alluvial soil, side roll sprinkler irrigation.



GROWER'S COMMENTS

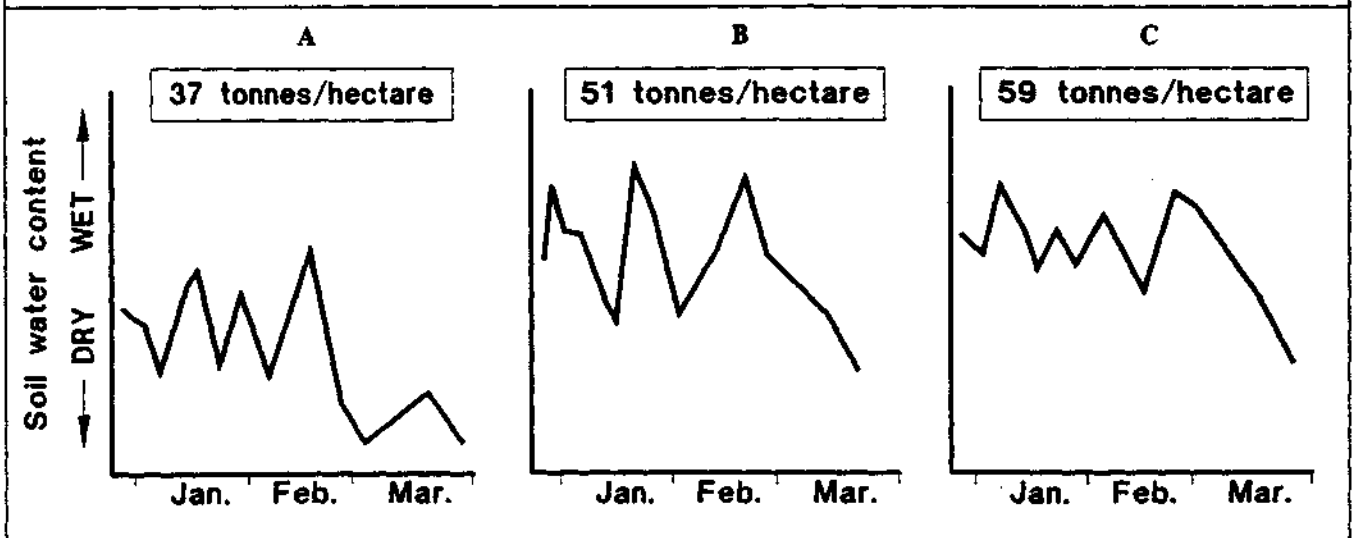
This season's use of the neutron probe and Water Watch gave me much better information than I previously obtained from using only tensiometers. The ability to visualise the soil moisture status from graphs produced by the software twice per week allowed much more objective and timely irrigation decisions.

During the season I aimed to irrigate on the dates suggested by the computer program. I was able to do this much more successfully on the drip and side roll blocks than on the furrow irrigated block.

Close consultation between myself and the extension officer on a bi-weekly basis during the early part of the season enabled me to understand very quickly what was going on regarding refill points, amount of water to be applied etc.

As I was doing the readings myself I was able to observe the crop's condition, record the crop particulars such as height, width and petiol sap nitrate. Although this took me

FIGURE 3: The effect of irrigation management on payable yield. These soil water 'time graphs' are from three commercial blocks, red levee soil, furrow irrigation supplemented with hand move sprinkler irrigation.



about four hours twice per week I consider that this was management time well spent. I feel many growers do not go into their crops enough. During the four hour probe recording time I also made many other vital management decisions.

The value of the exercise to me is that:

- I can lift my yields from 75 to 113 tonnes per hectare and possibly higher
- I was able to find out why my yields were low

On the furrow irrigated fields with the difficult red soil the water from the furrows was not getting to the plant. It was only when I was able to supplement the furrow irrigation with hand move sprinklers that I was able to catch up with plant water use.

Combining all the available data together on a computer software program is essential. It allowed me to gather all the management inputs together and enabled me to study the whole system in a simplified graphical output. There is no comparison with the previous manual operation that I have tried in past seasons.

SOME OBSERVATIONS BY EXTENSION OFFICER

The farmer recorded very accurately the number of bins and tonnage for each block, in fact for each row that contained a neutron probe access tube site. This diligence allowed us to analyse the yields from various parts of the fields and relate yield to soil moisture and the other parameters that were measured. In one field this recording showed the difference between drip rows where the 2.2 litres per hour drip lines yielded eight bins per row and one experimental row of 3.5 litres per hour drippers yielded 11.7 bins for an equivalent length of row.

The neutron probe gave us a "picture" of the soil moisture changes during the season. The blocks where soil moisture was kept high, and large fluctuations were avoided, returned the highest yields. It was also interesting to note that on the deep alluvial river soil the tomatoes used water down below 120cm (Fig. 2), while on the shallow red soils little water was used below 80cm (Fig. 1).

The continuing part of this project is to develop the strategies for scheduling irrigations for commercial processing tomato growing. This part of the project will continue into the next season.

Acknowledgement:

Funds and equipment provided by the Processing Tomato Research Committee, the Horticultural Research and Development Corporation and the Lachlan Irrigation Research and Advisory Council Inc. (LIRAC Inc) have enabled this co-operative project to be undertaken.

Better irrigation management is the key to improving yields and quality.

IRRIGATION MANAGEMENT OF PROCESSING TOMATOES

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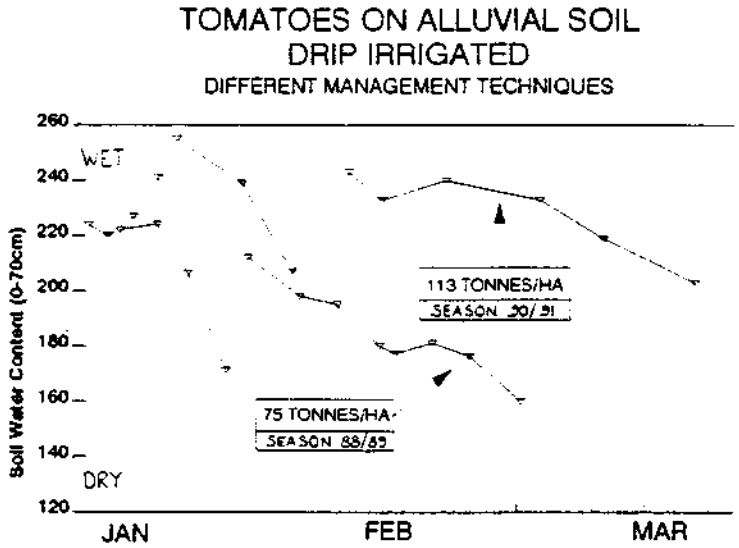

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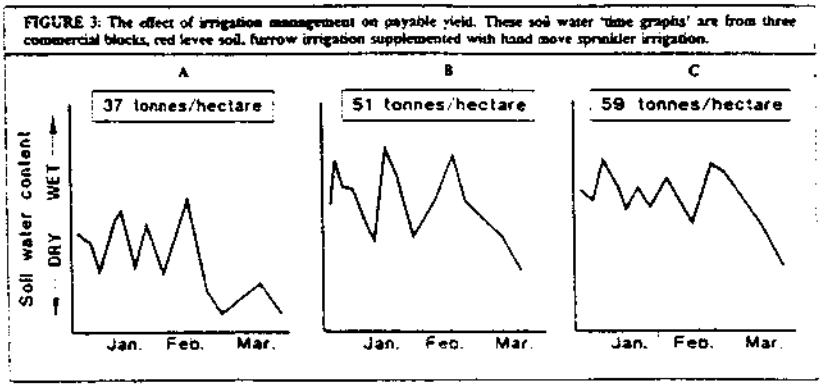

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