How Does EM Technology Affect Farm Profitability? A Study Investigating the Costs and Returns Associated with a Program Utilizing EM Technology on a Mixed Cropping Organic Farm in Canterbury NZ

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***Abstract** : Harts Creek farm utilises EM technology in all areas of its farming operation. To assess the potential profitability of using EM technology to the farm as a whole this paper produces financial comparisons using expected increases in yields based on research trials conducted on farms in New Zealand. The paper compares each enterprise with and without EM, based on expected costs and returns associated with each method. This paper is developed from earlier production data (Chamberlain et al 1997), and augmented with current financial information.*

Introduction

The restructuring of the agricultural sector in New Zealand over the past two decades has led to a dramatic improvement in farming efficiencies, as well as large scale diversification in farming operations. Whilst these changes have been largely driven by economic necessity, the world wide concern over genetic engineering from both an environmental (Hobbs, 2000) and food safety perspectives (Lamb et al 2001), is also affecting New Zealandís farming systems. A reflection of these effects is the increasing importance of organic production, and the growth of natural technologies used within organic management regimes. EM is one such advance which resolves environmental and safety concerns, and can potentially offer the producer improved economic performance.

To evaluate the economic potential of EM, this paper presents farm production data in conjunction with financial information to model the overall economic performance on two onion crops produced on Harts Creek Farm. Harts Creek Farm is located in Canterbury, New Zealand, and is a 160 ha mixed cropping and livestock operation with fertile heavy soils suited to both intensive cropping and sheep/cattle pastoral farming. The farm started an organic conversion program in 1986, and currently the total 160 ha is managed organically and certified for organic production by Bio-Gro NZ. Since 1994, when Professor Higa visited the farm, EM has been applied to pastures and crops and EM trials have been conducted on onion crops (Daly, 1995), and sheep production (Chamberlain 1996). Further on-farm trials have been carried out to improve the understanding of the use of EM on a large scale, in improving the efficiency of broadacre applications and economic returns.

This paper will use data collected from earlier field trials on pea and onion crops which compares EM and non EM crop production. Current costs and returns will be applied to the data and results discussed.

Methods

The data was provided from trials sited within 50 kms of Christchurch on Harts Creek and Wyenova farms. The trials were run in partnership with the farmers who cultivated, planted and managed the crop, and assisted with taking measurements. The crops all received irrigation when the farmer determined it was necessary.

The onion crops (*Alium cepa cv*. "Pukekohe Long Keeper") were grown on a "Wakanui" silt loam soil (Kear et al., 1967) which was prepared by rotary hoeing after a winter green feed crop in August. The field had previously been in ryegrass/white clover pasture for four years. The trials were direct seeded using a precision seeder in 1.5 m wide beds with four rows to the bed using a 300 mm between row spacing. Seed spacing within the row was 60 mm. The first trial had four replicates and a plot size of 5 by 1.5 m and the second trial had five replicates and a plot size of 5 by 1.5 m. For the first trial EM was applied at a rate of 10 L ha^{-1} with 10 L ha^{-1} of molasses mixed into water and applied at 10 000 L ha^{-1} through a watering can onto the foliage of the crop, on November 11, December 22 and January 20. In the case of the second trial, EM was applied at a rate of 10 L ha^{-1} with 10 L ha^{-1} of molasses mixed into water and applied either at 10 000 L ha^{-1}, through a watering can, or through a sprayer at 800 L ha^{-1}, or 200 L ha^{-1} onto the foliage of the crop. EM and Foliarfeed (fish based foliar fertiliser) applications began 27 September 1997, were repeated 2-3 weekly and concluded on 6 February 1998 (total of 9 applications). Crop vigour was accessed visually at bulbing (January 22). At harvest (March 1-7) the field dried onions were graded and weighed.

The process pea crop (*Pisum sativum* cv. "Princess") was grown on a Templeton silt loam soil (Kear et al., 1967)) which was ploughed after an oat grain crop. The straw was incorporated by cultivation during the winter. The peas were sown on 7 October at 290 kg ha^{-1} using a 15 cm between row spacing. In addition the field had a basal application of 250 kg ha^{-1} of reactive phosphate rock applied to correct a low soil phosphate concentration. The trial had four replicates and a plot size of 5 by 10 m. EM was applied at the previously described rate, twice during crop growth (at mid flower and at early pod development). The crop was irrigated on the 16 and 23 December, and harvested on the 31 December.

Results

Financial Information

Table 1.describes current cost and returns used in the calculation of crop profitability on both peas and onions. The cost structure for land preparation, crop management, harvest, process and packing costs are calculated on the basis of tonnes per hectare, and indicate a positive scale effect as shown in Figure 1. below. The costs associated with 50 and 60 tonnes/ha production levels were forecast using input data associated with lower levels of production, using a non linear least squares technique. This excludes the treatment costs, ie those costs additional to the production costs, listed in Table 1.

Table 1. Pea and Onion Financial Information

Costs	Onions	Peas
Production Costs*	$296/tonne	$1400/ha
EM	$170/ha	$68/ha
RPR	$200/ha	$60/ha
Biophos	$400/ha	
Blood & Bone	$600/ha	
Seasure (foliafeed)	$300/ha	
Farmers Mix	$1100/ha	
Trace Elements		$20/ha
NPKS	$1350/ha	
Returns		
First grade	$1.00/kg	
Other grades	$0.60/kg	
Bio Gro Grade 5		$420/tonne

*includes preparation, crop management, harvest, process and packing costs

Financial Performance

Table 2 that follows describes the financial costs and returns, when they are applied to both the onions and pea trial data. Points to note are:

With onions, the application of Biophos produced the highest overall level of production in trial one, with just over 55 tonnes/ha. In the second trial the application of EM and molasses produced the highest overall level of production with 74 tonnes/ha. However, when the production data is combined with the financial information, EM produced onions had the highest gross margin in both cases, $38,818/ha in the case of the first trial data set and $38,090/ha in the case of the second data set.

In the first trial, EM produced the highest relative percentage (82%) of first grade onions and in the second trial EM produced 68% of first grade product which was slightly less than the Fertiliser (NPKS) 70% and Foliafeed 73% trials.

The EM pea production trial produced a higher level of production than the control group which translated into the highest gross margin of $1892/ha.

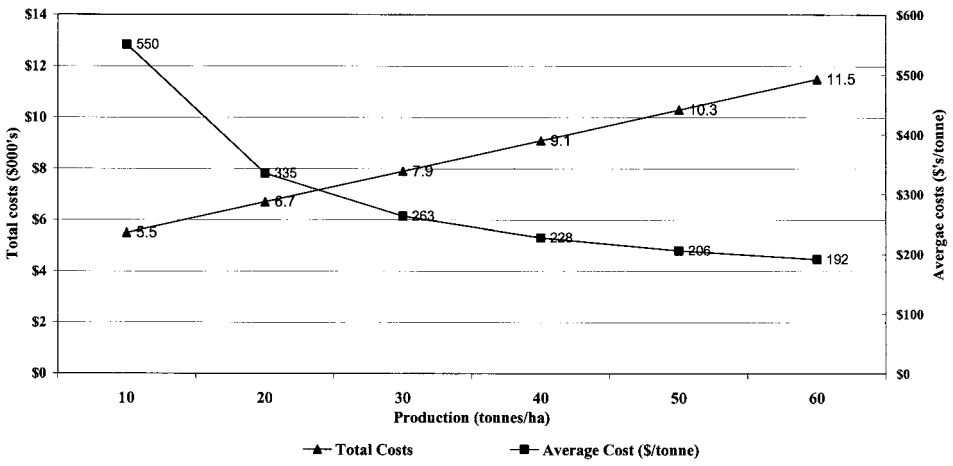

Figure 3. Total and Average Onion Variable Costs

Table 2. Production and Gross Margin Information

Crop	Total Yield (t/ha)	First grade	Process small & reject	% First grade	Gross Return	Costs/ha	Gross Margin
Onion-Trial 1							
Control`	41.7	25.0	16.7	60.0	$35,020	$9,304	$25,716
RPR	49.2	34.9	14.3	70.9	$43,480	$10,404	$33,076
Biophos	55.1	39.7	15.4	72.1	$48,940	$11,312	$37,628
Blood & Bone side	52.4	41.3	11.1	78.8	$47,960	$11,188	$36,772
RPR plus Blood & Bone	52.1	38.1	14.0	73.1	$46,500	$11,352	$35,148
Seasure	51.9	32.9	19.0	63.4	$44,300	$10,828	$33,472
EM	**53.6**	**43.9**	**9.7**	**81.9**	**$49,720**	**$10,902**	**$38,818**
Farmers mix	48.2	35.6	12.6	73.9	$43,160	$11,184	$31,976
Onion-Trial 2							
Control	65.0	32.0	33.0	49.2	$33,200	$10,300	$22,900
Control + molasses	66.0	42.0	24.0	63.6	$42,600	$10,660	$31,940
EM + molasses	**74.0**	**50.0**	**24.0**	**67.6**	**$51,200**	**$13,110**	**$38,090**
Foliafeed (fish based foliar)	62.0	45.0	17.0	72.6	$46,200	$11,800	$34,400
Foliafeed + EM + molasses	69.0	44.0	25.0	63.8	$45,200	$12,330	$32,870
Fertiliser (NPKS)	64.0	45.0	19.0	70.3	$45,600	$12,970	$32,630
Peas							
Control	6.1				$2,562	$1,400	$1,162
EM + molasses	8.0				$3,360	$1,468	$1,892

Discussion

The use of EM, produced onion and pea crops with the highest gross margins not only because of increased overall total production, but perhaps more importantly, in the case of onions, because of the higher percentage of first grade onions produced when using EM. It should be noted however, that the production data used in this paper were from trial plots and variations from these production levels could be expected under normal growing and management regimes. It should also be noted that the cost structures used in these trials were specific to the farms where the trials were undertaken and could be expected to vary in other farming situations.

From an economic perspective the results of the financial analysis in this paper indicate that the use of EM on onions and peas produces the highest financial returns when compared to other forms of fertiliser applications.

Results from the use of EM in lamb production indicate similarly higher levels of productivity, however, until this is incorporated with financial information the affect on farm profitability is uncertain.

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