Mechanising agriculture using animal traction and small-scale irrigation

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Abstract

A development project at the University of Fort Hare, aimed at producing vegetables and other cash crops on a commercial basis using draught animals and a small low cost irrigation plant, has produced realistic figures, which indicate that small scale farmers, cultivating from one to five hectares under this system can realise a substantial net profit and an annual income, which will allow them an adequate living standard.

The project, which has been run in a manner similar to the communal grazing system combined with small cultivated lands which is practiced in the communities surrounding the Fort Hare University, has shown that with comparatively low initial investment costs and minor running costs, such a system ensures that a small scale farmer can keep loan repayments down and realize substantial net profits on his cash crops as a result.

The project, which has been operating for two years has had a strong developmental bias and has resulted in useful data being collected, which in turn has indicated the practicalities of farming in this way and furthermore has revealed the potential of the system for enabling small scale farmers to make a reasonable living.

Introduction

Crop production in the Eastern Cape province of South Africa is currently at an all time low. Several factors favor the re-emergence of small scale farmers in the area, for example there is high unemployment and access to food products in the rural areas in the region depend largely on imports from other regions (Gebeda 1999). There are other factors which make food security difficult in the rural areas. Farmers are aging and most are retired, farming is not their profession, more of a part time occupation. Most of the youth have migrated to the urban, areas where expectations of employment are higher, they do not see agriculture as a viable career opportunity; they do, however, still return to the rural areas for food. Crop production in the rain fed areas is a high risk venture as rainfall is low, livestock encroachment on lands due to lack of adequate fencing is common, there is a lack of a proper agricultural infra structure, crime and particularly, theft of livestock and agricultural products, is rife and the land tenure system is insecure.

The scope for irrigation in parts of the Eastern Cape is high. Many large rivers flow from the high mountain regions, where rainfall exceeds 1000 mm per annum, through relatively dry areas with low and erratic rainfall. On the banks of these rivers lie numerous arable areas of land ranging from a one to ten or more hectares in area, (Pearson *et. al.,* 1999).

An investigation into food plot production at irrigation schemes in the central Eastern Cape, (W van Averbeke *et. al.,* 1998) has showed that irrigated plots of 2 ha are large enough for agriculture to be the major source of income provided farmers adopt farming systems, which suit small scale agriculture while at the same time generating adequate profits.
The use of animal traction, is cited as a viable power option for such farmers.

In an attempt to overcome some of the problems listed above the Animal Traction Centre (ATC) at the Fort Hare University initiated a project to consider ways to increase crop production by complimenting animal traction with a small scale irrigation plant. This paper reports on the initial investigations and the results obtained so far.

Project purpose

The project was undertaken with a view to ascertaining whether it would be possible to use draught animals together with a small scale irrigation plant to produce cash crops, mainly vegetables on a commercial basis but also maize and fodder crops for domestic use and for supplemental feeding of the draught animals.

Method

Crops were produced by preparing the lands using draught animals and sowing/planting by hand.

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Subsequent weed control and harvesting was done using draught animals and manual labour. When rainfall was low or erratic a small irrigation plant was used to supplement the deficiency.

Land area and equipment

The total area under cultivation was 1,46 ha, which was divided into five lands as indicated in figure 1. The outer perimeter was fenced to keep out livestock. The whole area was cultivated using two oxen with a small mouldboard plough, a two piece diamond spike toothed harrow, a ripping device which was attached to the plough beam after removal of the mouldboard, landslide and share and a small cultivator, which was pulled by a single horse.

A small irrigation plant comprising an engine and pump complete with a 4m suction line mounted on a wheel barrow for easy movement, a 50m length of black polyethelene pipe 75mm in diameter and 8 stand pipes with sprinkler attachments supplied by 15, 6m lengths of galvanized 75mm diameter irrigation piping as well as the necessary fittings and connections.

In addition to the above trek gear for inspanning the oxen including yokes, skeis, strops, trences, riems, chains and harness for the golovan was provided. The total capital investment required is shown in Table 1.

A small one ox cart was used for all cartage activities and a small knapsack sprayer was used for the spraying of crops.

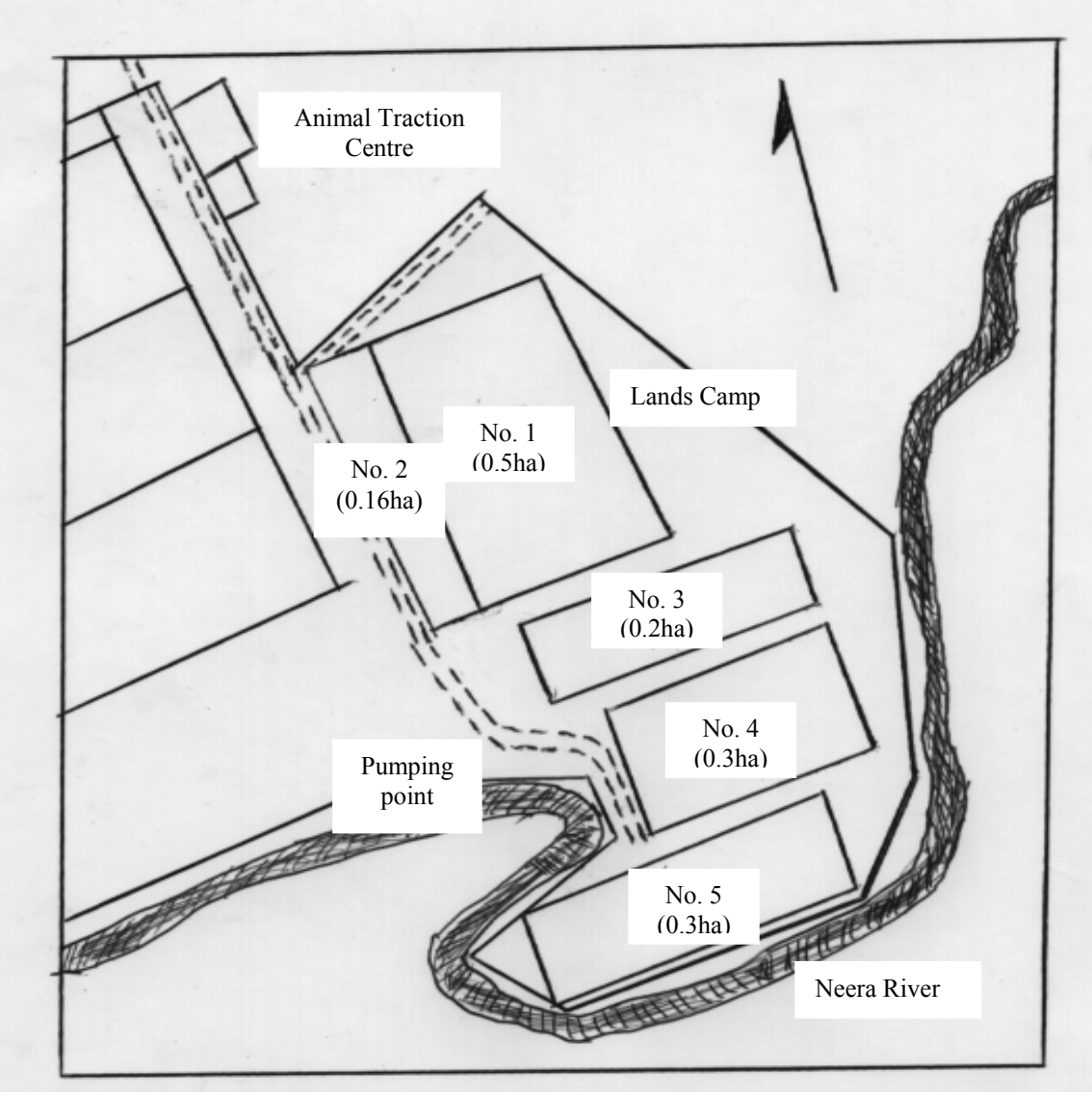

Figure 1: Small farm plan showing the five lands which are cultivated.

Table 1: The capital investment required.

Item	Quantity	Unit cost (R)	Investment (R)
Oxen	2	1750:00	3 500:00
Plough (Maun)	1	450:00	450:00
Harrow (two piece)	1	550:00	550:00
Ripping attachment	1 set	350:00	350:00
Cultivator (Maun)	1	475:00	475:00
Golovan ox-cart	1	3 000:00	3 000:00
Trek gear	For 2 oxen	450:00	250:00
Breaching/Golovan	1 set	150:00	150:00
Spades and hoes		450:00	450:00
Hand tools and axe		450:00	450:00
Irrigation plant	1 Unit	9 500:00	9 500:00
Fencing	Perimeter	8:00	8 000:00
Knap sack sprayer	1	450:00	450:00
Total			**27 575:00**

Crop production and marketing

No artificial fertilizer has been applied up to the present time, but since commencement of the trial all the lands have receive one top dressing of 'kraal manure' (30 tons per ha), put down by one ox inspanned in the golovan cart.

Seeding of oats was been done by hand into lands, which had been ploughed and harrowed and which were again harrowed after broadcasting.

Seeding of row crops such as maize was done using the ripper into lands, which had been ploughed harrowed and ripped with the ripper tine to produce straight furrows into which the maize seed was sown by hand and then harrowed over with a spike toothed harrow

Seeding of potatoes was done by hand behind the plough every 4th furrow and then harrowed over with a spiked toothed harrow. Ridging was done by hand, but in future will be done using an animal-drawn ridger.

Seeding of pumpkins was done using the ripper tine to produce straight rows in a previously ploughed and harrowed land and then planting in rows two meters apart with an in row spacing of two metres. The seed was covered using a hand hoe.

Cabbages seedlings were planted in rows (800x800) mm apart so as to have rows up and down as well as across the field to facilitate cultivation.

The planting details of all crops grown to date are indicated in Table 2. This table also contains the input costs of seed, insecticide and the total cost of owning and operating the irrigation plant, as well as the yields and gross income for each crop.

Ploughing depth was about 180mm on average and it took about three working days of 6 hours each to complete 1 ha of ploughing. Harrowing was done with a spike-toothed harrow and two oxen, at a rate of about 4 hours per ha. Weeding was done with a small cultivator and one horse (One of the oxen could have been used, but to date it has not been possible to acquired a single ox yoke). It takes about 6 hours per ha to cultivate a crop of cabbages 'one way' up and down the field.

The harvesting of maize was by hand. The cobs were stripped and loaded into the golovan for transport to the shed where they were shelled using a hand sheller before being bagged in 50kg bags. These were then sold in the local communities for R 50 per bag. Maize stover were cut and fed to Fort Hare cattle . The oat hay was cut with a horse drawn mower and then raked and baled using a tractor. It was then used as supplementary feed for the draught animals after which the balance was sold to the research farm for R12 a bale.

Cabbages pumpkins and potatoes were harvested by hand (the latter with hand forks) and then sold to members of the local communities (shop keepers and individual buyers) who arrived at the ATC and purchased them in the field. Cabbages and pumpkins were sold loose potatoes were sold in 15kg bags.

Silage was cut using a tractor and silage cutter and sold to the research farm at R 250 a ton.

Draught animal management

The two oxen grazed on the research farm in a manner similar to the communal grazing practiced in the rural areas adjacent to the university research farm. They were fed supplementary oat hay only when necessary, which was usually in the dry winter months prior to ploughing. Minimal veterinary care has been necessary to date and the major cost in this regard has been that for tick control (dipping once every two weeks in summer, less frequently in winter).

Table 2: Crop production details.

Date	Land (No)	Land area (ha)	Crop	Seed Cost (R:C)	Irrigation (R:C)	Insect-icide (R:C)	Tran sport (R:C)	Rain fed / irrigated	Input cost (R:C)	Yield (Tons)	Gross Profit (R:C)
1996/7 S	1	0,5	Maize	18	92		20	I	R130	12 Silage	R 3 000:00
1996/7 S	5	0.26	Maize	9	51		5	I	R65	4,5 Silage	R 1 125:00
1997 W	1	0,5	Oats	68				R	R68	4,26	R 2 376:00
1997 W	5	0,26	Oats	34				R	R34	3,17	R 1 620:00
1997 W	2	0,15	Cabbage	164	7 75	65	20	I	R1024	4,5	R 1 794:00
1997/8 S	3	0,2	Pumpkin	498	204	193+16		I	R911	6,8	R 3 414:00
1997/8 S	4	0,3	Potatoes	1623	775	48+345		I	R2791	4,98	R 5 475:00
1997/8 S	1	0,5	Maize	18		18	5	R	R41	Failed	Nil
1998 W	1	0,5	Fallow					R	Nil	Nil	Nil
1998 W	2	0,2	Oats	35				R	R35	2,4	R 1 309:00
1998 W	3	0,25	Oats	40				R	R40	1,4	R 764:00
1998 W	4	0,3	Oats	50				R	R50	1,76	R 960:00
1998 W	5	0,26	Oats	40			20	R	R60	1,25	R 682:00
1998/9 S	1	0,5	Maize	21	673	19		I	R713	1,75	R 1 750:00
1998/9 S	2	0,2	Cabbage	198	316	38	20	I	R572	9,7	R 4 100:00
1998/9 S	3	0,25	Maize	10	51		5	R	R66	1,5	R 375:00
1998/9 S	4	0,3	Fallow					R	Nil	Nil	Nil
1998/9 S	5	0,26	Fallow					R	Nil	Nil	Nil
1999 W	1	0,5	Cabbage	474	367	130	20	I	R991	Harvest	November
1999 W	2	0,2	Cabbage	190	408	70	20	I	R668	7,15	R 2 500:00
1999 W	3	0,2	Cabbage	237	438	33		I	R708	6	R 3 444:00
1999 W	4	0,3	Oats	50	51			I	R101	1.75	R 1 036:00
1999 W	5	0,26	Oats	50			10	R	R60	1,475	R 885:00
1999/20 S	1	0,5	Cabbage					I			
1999/20 S	2	0,2	Potatoes	1080				I	To	Plant	
1999/20 S	3	0,2	Cabbage					I	To	Plant	
1999/20 S	4	0,3	Trial St. Ayres					R	Nil	Nil	Nil
2000 W	5	0,26	Lucerne					I	To	Plant	
Total									R9148		R35 995:00

Conclusion

The development of this small farm has taken place over a period of two years. During this time it has been ascertained that all the activities can be carried out with two oxen using the equipment listed above and that a minimum of two people can provide all the manual labour. An attempt has been made to allow short resting periods for each of the fields over the two year period, usually for one season only and to ensure that each year sufficient fodder is produced to provide the supplementary feeding requirements of two draught oxen. Some hay making activities have been carried out using a tractor, tractor-drawn rake and a baling machine. This has been necessary because there have not been animal drawn implements available to do this work. There are plans for the acquisition of an animal drawn hay rake in the near future, which will allow the fodder to be conserved in haystacks.

The experience has been a learning process, which started on a small scale, with the production increasing as confidence was gained.

It is now possible to plan a crop and fodder production programme for the farm, which will provide a gross income of between R 30 000 and R 40 000 per annum off the 1.46 ha currently under cultivation. The input cost for seed, pesticide and for the irrigation would then be between R 5 000 and R 6 000 per annum.

It will be possible to increase the area under cultivation to about 2 ha in the future and this will mean an increase in the above figures to an income of about R 49 000 for an input cost of about R 8 000 per annum.

The above assumes that the labour input is provided by the family and that the net profit will be the family earnings for the year.

It is planned to continue with the study for the foreseeable future and to continue with the publication of the results on an annual basis.

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