

6

Experimental Trials

6.1 GENERAL

During 1980, various crop production trials using work oxen were carried out at Njala University College. The trials involved the growing of maize, cowpeas, groundnuts and swamp rice in plots of about one-fiftieth of a hectare (one-twentieth of an acre). In some plots various ox-cultivating techniques were used and in others tractor or hand cultivation methods were employed. Each method of cultivation was carried out in three separate plots to ensure that local differences in environmental conditions did not bias the results. Treatments were allocated to plots in a random way so that any bias in the selection of plots was avoided. The time required for all work operations on each plot was recorded and the average was calculated from the three results.

Samples of the weeds from each plot were taken from measured areas and their weight recorded, both fresh and dried. The average weights were then calculated for comparison of weed growth in the different management systems. The yield from each plot was also recorded separately and the averages for different treatments compared.

In general everything about the different plots and their management was the same and only the things being studied - the method of ploughing, harrowing, planting, weeding and harvesting, differed. The recorded information was analysed statistically and differences were only considered to be significant if there was less than a 1 in 20 probability of the differences being attributable to random chance. The technical details of all the trials, together with the results presented in SI units are given in Appendices 1-4 covering Maize, Groundnuts, Cowpeas and Swamp Rice. A brief non-technical summary of the results of the cultivation trials using imperial units is given below.

6.2 UPLAND MAIZE

Maize was grown in rows using four systems of cultivation:

- Hand labour only;
- Tractor ploughing and harrowing followed by hand operations;

- Ox-ploughing and harrowing followed by hand operations;
- Ox-ploughing and harrowing followed by ox-seeding and ox-weeding with some hand weeding and hand harvesting.

The labour requirement was greatest for hand operations (64 mandays/acre) and least for full ox-cultivation (20 mandays/acre), as illustrated in Fig 6.1. Weed growth after one weeding was highest following hand cultivation and lowest when the land had been ploughed by oxen or a tractor. However, weed regrowth was lowest of all following weeding with ox-drawn tines as illustrated in Fig 6.2.

Grain yields from plots which had been hand hoed and hand weeded were lower than on plots which were cultivated with ox-ploughing or tractor ploughing, although the difference was not sufficiently pronounced to rule out the possibility that this may have been due to chance. Two systems of ox-equipment were used in the trials - the Anglebar and the Sine Houe, which ploughed and weeded equally effectively.

6.3 GROUNDNUTS

Groundnuts were grown during the rainy season in upland soil at Njala using two systems of cultivation. One involved hoeing the ground, broadcasting the seeds, weeding with a short-handled hoe and lifting by hand. The other involved ox-ploughing and harrowing, planting in lines with a seeder, ox-weeding between the rows and lifting the groundnuts using an ox-drawn groundnut lifter.

Times were recorded for all operations and the use of hand tools to cultivate groundnuts was found to require six times the labour than that used for ox-drawn equipment, (Fig 6.3). Ox-weeding led to a significant reduction in weed growth compared with weeding with a short-handled hoe, (Fig 6.4). From the results of the trial and from assessments made during the different operations, it is considered that cultivation of groundnuts in rows using ox-drawn equipment is quicker, more efficient, and much less arduous than hand cultivation.

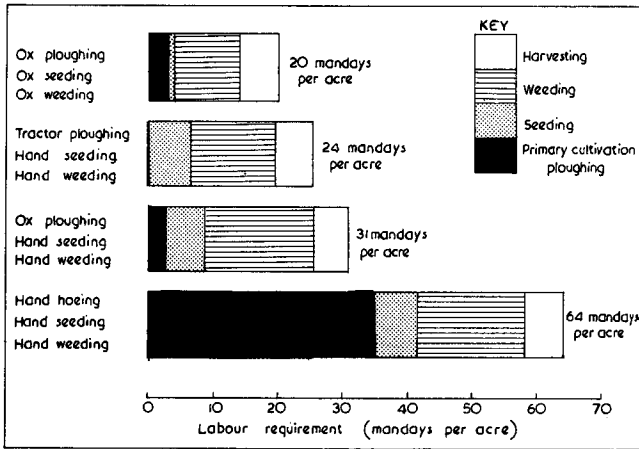


Fig 6.1 Labour requirements for different systems of row cultivation of maize.

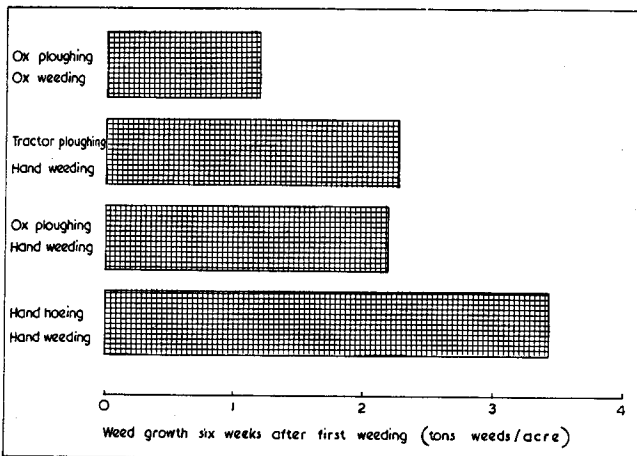


Fig 6.2 Maize trial. Weed regrowth following different cultivation systems.

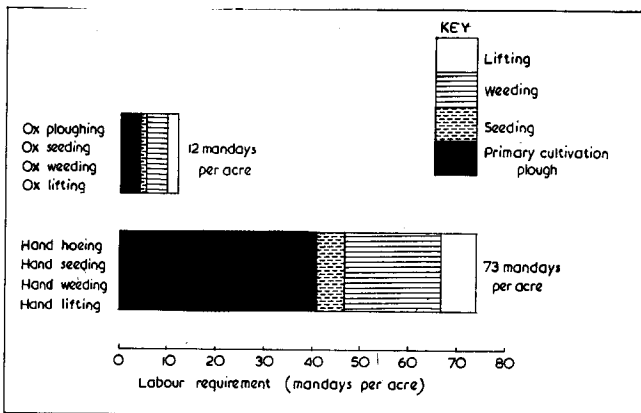


Fig 6.3 Labour requirements for different systems of groundnut cultivation.

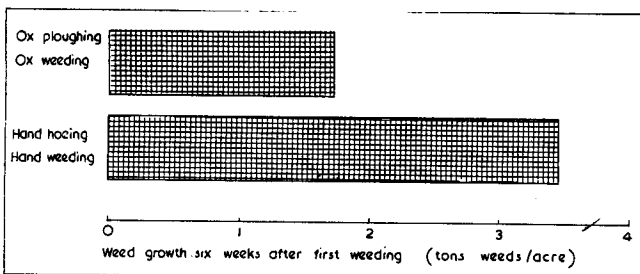


Fig 6.4 Groundnut trial. Weed regrowth following different cultivation systems.

6.4 COWPEAS

Cowpeas were grown in upland soils towards the end of the 1980 rainy season. Four systems of cultivation were compared:

- Hand tool operations with traditional 'scattered' spacing;
- Ox-ploughing with hand planting in rows and hand tool weeding;
- Ox-ploughing, hand planting in rows and ox-weeding;
- Ox-ploughing, ox-planting and ox-weeding.

The labour requirement for the different systems was greatest with hand operations, (96 mandays/acre) and least for full ox-cultivation (45 mandays/acre), see Fig 6.5. Under all management systems, yields were similar, but the use of oxen for cultivation required much less labour. Hand planting in rows took longer than hand planting using more random spacing, but row planting allowed ox-weeding which required only half the labour of hand weeding. From the results of the trial it is considered that cultivation of cowpeas using work oxen is an extremely attractive proposition.

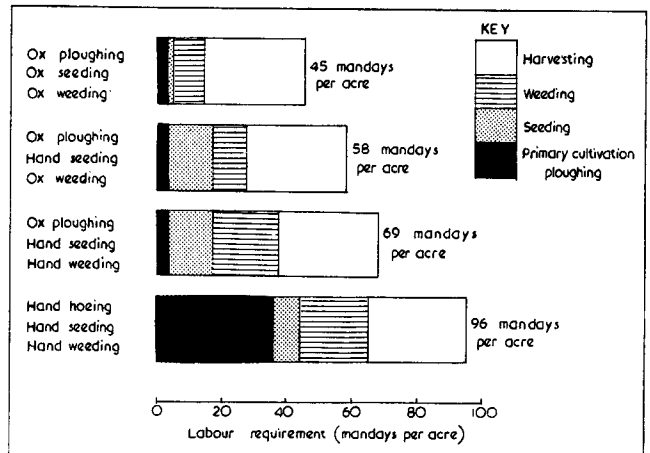


Fig 6.5 Labour requirements for different systems of cowpea cultivation.

6.5 SWAMP RICE

Rice was grown in a semi-developed swamp using hand cultivation and also using two systems of ox-powered cultivation. In one ox-powered system ploughing was carried out before flooding and in the other it was carried out with about 4" of water on the surface. Rice seedlings were transplanted in all systems as the water level could not be sufficiently controlled to allow direct seeding.

Preparation of the swamp for transplanting required 29 mandays/acre using hand cultivation methods, but a total of only 7 mandays/acre spread over 9 working days were required when oxen were used to plough, harrow and level the swamp. Ox-ploughing in the swamp before flooding was easier and quicker than

in flooded conditions, but puddling was better following ploughing in flooded conditions. Both ox-cultivation systems required similar work and were both effective and it was concluded that, where possible, swamps should be ploughed in damp conditions without surface water and that flooding should immediately follow ploughing.

There was no significant differences in the yields produced in the different systems, but the trial did produce information on the labour requirements.

Each of the nine plots was divided into two. One half was harvested by cutting off each panicle with a knife (the traditional system in much of the Southern Province), and in the other half the whole stem was cut with a sickle (a system more commonly found in the north of the country.) The panicle system required more than twice the labour of the stem system (39 mandays/acre as opposed to 16 mandays/acre). Cutting the whole stem leaves the swamp in a suitable condition for re-ploughing, while harvesting only the panicles leaves the straw standing, which interferes with reploughing. It was therefore concluded that the system of harvesting the whole stem should normally be recommended.

The trial provided data on actual work rates of oxen and manual labour during swamp rice cultivation, (Fig 6.6).

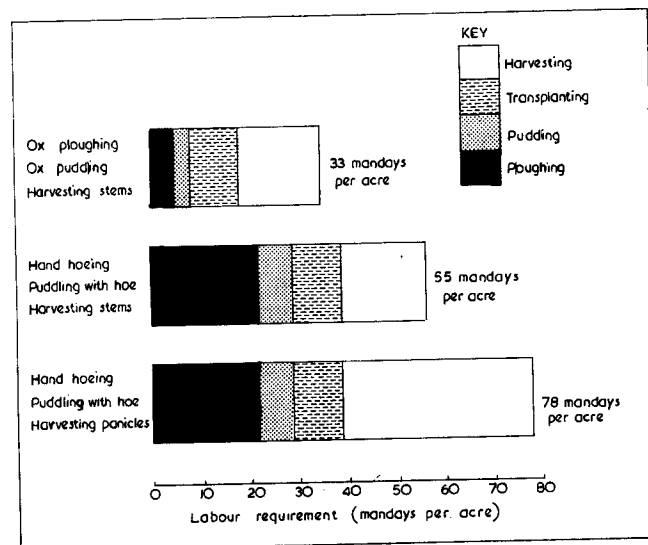


Fig 6.6 Rice trial. Labour requirements for three systems of swamp rice cultivation.

6.6 OTHER EXPERIMENTAL TRIALS

A trial using oxen to cultivate upland rice was started but had to be abandoned following some heavy storms which decimated the young seedlings. The results of the ground preparation operations confirmed the results of other upland trials - that the use of oxen for land preparation requires only one-seventh of the labour required for cultivation with hoes. Upland rice was sowed successfully with the Super Eco Seeder, but this would only have had real value if a system of ox-weeding between the rows had also been employed.

A trial to compare the effectiveness of weed control using hand cultivation, ox-ploughing and ox-cultivation with spring tines was initiated. Spring tines can be used as an alternative to ploughing, and the 3-tine weeders are supplied with narrow points for primary cultivation. Cultivation with spring tines was quicker than normal ploughing (5 hrs/acre as opposed to 8 hrs/acre), but required 25% more average effort and 70% more peak effort. Weed growth was clearly greater following tine cultivation than following ploughing, but while this could be clearly seen on inspecting the plots, insufficient objective measurements were taken to quantify the difference.

6.7 CONCLUSIONS

Full details of the main trials are given in Appendices 1-4. Much general information gained from the trials has been used in the preceding chapters and many of the economic arguments presented in the next Chapter are based on the work rates achieved in these trials. It is accepted that the requirements for objective replicated trials designed to yield specific information free from environmental biases are such that the conditions inevitably differ from those found in village farming. Nevertheless, these trials, with their acknowledged limitations, have provided some basic information on both advantages and disadvantages of ox-cultivation. It is therefore considered that, together with farmer surveys, this will be of value in appraising the potential for ox-cultivation techniques in the country.