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How efficient are seeding operations — Kondinin work study

By E. J. Roberts, Marketing and Economics, C. R. Lester, Narrogin Office, and J. E. Young, Consultant.

The efficiency of machinery and labour during seeding operations was studied in 1977 by the Kondinin and Districts Farm Improvement Group and the Department of Agriculture. The aim was to find what influenced efficiency during cropping. Time spent on repairs, maintenance, meals and other incidental jobs considerably reduced the time spent driving the tractor.

Each farmer participating in the study was given the results for his own farm compared to the group, indicating tasks most needing improvement.

A trend in cereal farming in Western Australia in recent years has been towards the use of "big" machinery. However, farmers in the Kondinin and Districts Farm Improvement Group found that they were not getting the results expected from new machinery. The heavy investment but mediocre performance prompted them to look into the problem.

They found that little was known about what influenced performance of machinery and labour during the cropping operation, and therefore asked the Department of Agriculture to study the problem. The group also secured the services of an industrial engineering consultant, Mr J. E. Young.

The problem was approached by surveying farms in Kondinin and surrounding areas to find what delays occurred during seeding time. Farmers involved in the survey kept records of time spent on their daily activities. Categories of activities were driving the tractor, shifting, maintenance, repairs, setting up, filling, supplies to paddock, refuelling, meals, personal, not working on the job, managing and travelling.

To check the accuracy of these self-kept records, Department of Agriculture advisers also recorded in detail the activities of randomly selected farmers at randomly selected times.

The Kondinin area

The study was mainly in the Shires of Kulin and Kondinin, with a few farms in the Shires of Lake Grace and Narembeen.

Rainfall in the area is between 300 mm and 350 mm. The main soils are heavy soils which are the most fertile, sandy surfaced soils with clay subsoil, and sandy gravels overlying either dense gravel or ironstone.

The winter rainfall has a marked influence on machinery use in this area. The crop is normally sown.
as the season is getting wetter and the likelihood of boggy conditions increases, especially on the heavy soils. Traction and the ability to cover large areas quickly are thus important. Land must be prepared and seeded quickly before the land becomes too wet to work or it is too late in the season. The five to five and a half month growing season is already close to the minimum for good yields, and seeding after the end of June may reduce yields by up to 0.5 tonnes per hectare.

Farms in the survey
The cropped areas of farms in the survey ranged from 208 ha to 2,744 ha with an average of 906 ha. Sixteen (31 per cent) of the farms had only one tractor and 21 (61 per cent) had two tractors. Ten (8 per cent) of the tractors were 4-wheel drive while 33 (31 per cent) were over 80 kW power. Tractors less than three years old were more powerful, suggesting that farmers buying new tractors have usually purchased a more powerful one.

Fifty-seven (46 per cent) of tractors were less than three years old, purchased between 1975 and 1977, a time of high grain prices and the 40 per cent investment allowance.

Investment in tractors on each farm ranged from $5,000 to $105,000, with an average of $34,000.

The main implements used in the cropping programme were disc ploughs, scarifiers, tyne cultivators and combine and air seeders. The most common sizes were 24, 25 and 29 tyne scarifiers; 18, 22 and 24 disc ploughs; 9 metre tyne cultivators and 24 and 28 run combine seeders.

Like tractors, cultivation and seeding equipment reflects the recent updating of machinery on many farms; 30 per cent of the implements were less than three years old. Many farmers are using old plant with a newer, more powerful tractor pulling it in tandem.

Investment in cultivation and seeding equipment ranged from $7,000 to $68,000 with an average of $25,000.

The total investment in tractors, seeding and cultivation equipment reflected the size of the cropping programme.

Thirty-eight farmers (61 per cent) used bulk seed and fertiliser during cropping. These farms had an average cropped area of 1,070 ha, but farms using bags had an average cropped area of only 530 ha.

Fertiliser and seed storage facilities varied from farm to farm. Bulk fertiliser storage ranged from well-designed, concrete-lined sheds to make-shift dumps.

Seven (11 per cent) of the farms were one-man units, and there was no relation between the number of labour units and the size of the cropping programme. Family labour was used on many farms.

Efficiency
In the study the activity “driving the tractor” was used to indicate the efficiency of the cropping operation. Whilst not a measure of efficiency of individual tractors, time driving the tractor does reflect the overall efficiency of cropping on the individual farm.

The wide range in the percentage of time spent on the different activities including driving the tractors, indicates the differences between farms. However, the time spent driving the tractors was mainly reduced by maintenance, repairs, setting up, meals, not working on the job, or managing. The greatest loss of driving time was due to maintenance, repairs and not working on the job. (See later).

Driving the tractor
The average percentage of time driving the tractor over all farms and operations was 55 per cent. It ranged from 31 per cent to 78 per cent.

There was little difference between the percentage of time spent driving while working up (63 per cent) and working back (62 per cent). The time spent driving the tractor in both these operations was influenced mainly by the time spent on repairs, maintenance, not working on the job and meals.

During spraying, large amounts of time spent on supplies, repairs and not working on cropping reduced the percentage time driving to only 29 per cent. However, because the spraying figure included farmers who simply carted water for contractors it is artificially low, and the figure for farmers who did their own spraying was 42 per cent.

Seeding had a 46 per cent driving time, influenced mainly by the time spent on filling and supplies.

Shifting
The average percentage time spent on shifting was 4 per cent with a range of 0.7 to 9 per cent. Time spent on shifting was similar for all operations. Shifting was only a delay where farmers were operating on two or more farms, several kilometres apart.

Repairs and maintenance
The average percentage of time spent on repairs and maintenance was about 6 per cent in each case.

Both considerably reduced the percentage time driving the tractor on most farms. However, more time spent on maintenance did not reduce repair time, although pre-season maintenance was not recorded.

The percentage of time spent on repairs did not increase as more cropping was attempted. Repair time was more influenced by the complexity of the breakdown, which often required an experienced mechanic; and the availability of spare parts. Trips to town or Perth for parts were not uncommon and time spent waiting for parts was also noticeable.

The survey was not big enough to indicate whether repair time increased with older machinery, but new or near-new machines were not repair free.

The amount of time spent changing scarifier points was of major concern to many farmers.
Using the cultivator section of an air seeder for working back

Filling combine from bags. Handling of grain from bags was slower than bulk handling

Filling combine from 5:1 bin. Filling and supplies to the paddock took a large amount of time during the seeding operation

Repairing broken disc journal. Repairs were a major factor influencing efficiency
Repairs took up to 9 per cent of total time during spraying suggesting that the spray rigs were not suitable for the conditions. They appeared too fragile for the speed at which the farmers were using them and the terrain over which they were travelling.

Refuelling
Refuelling took an average of about 1 per cent of total time. Farmers using power driven pumps could continue with other activities such as maintenance and meals.

Setting up
Setting up took up an average of 2 per cent of the total time, and appeared to be related to the size of paddocks and consequently the number of shifts. Gate size and the use of hitches was also thought to influence the time spent on setting up.

Filling and supplies
The time spent on filling and supplies was significant in the spraying and seeding operations. Filling and supplies took up an average of 20 per cent during seeding and 25 per cent during spraying. A considerable amount of the time was spent supplying water to the spray rig. This was because farmers had to travel up to 10 to 15 km to obtain suitable water, and carting water to the paddock accounted for 16 per cent of the total time. Some farm supplies were polluted with algae or had too much clay in suspension, and could have blocked nozzles.

The large amount of time spent on supplies and filling during seeding appeared to be caused by poor shed layout, poor bucket capacity, poor bulk bin design and capacity, distance from shed to paddock, small combine box capacity and the method of seed and fertiliser handling.

Bulk filling averaged 9 per cent of total time while bag filling averaged 13 per cent. However, there was no difference between the time for filling air seeders and conventional seeders. This may have been because the capacity of current models of air seeders was not much greater than the combine seeders. Also the rate of output from the bulk bins was not fast enough to take advantage of the convenience of the air seeder.

Meals and personal
Meals took an average of 6 per cent and personal matters took 0.7 per cent of time. Fifty-five (87) per cent of the farmers spent less than the 10 per cent of time considered adequate for similar working conditions in industry. The break for a meal was considered desirable to reduce boredom, and eating while driving, unless absolutely necessary cannot be recommended. A lot of farmers refuelled and carried out maintenance during their meal breaks.

Not working on the job
The time spent not working on cropping averaged 8 per cent but ranged from 0.1 to 19 per cent. Many farmers became pre-occupied with other jobs like sheep work and household chores.

Managing and travelling
Managing and travelling both took up on average about 1 per cent of time. Time spent on managing generally increased with the number of operations while travelling was highest for those farmers with two or more farms.

Size of cropping programme
Investment per hectare in machinery did not reduce the percentage of time driving the tractor, although it did, of course, reduce the time per hectare of crop. Also the size of the cropping programme did not affect the percentage of time driving the tractor.

CONCLUSION
The main task in the cropping programme is to sow as quickly and efficiently as possible. This is influenced mainly by the amount of time the plant is operating. By examining the time operators spent on activities associated with cropping, this study has pointed to activities which consume considerable amounts of time, and consequently reduce the time the plant is operating. These activities are maintenance, repairs, filling, supplies and not working on the job. Differences between participants in percentage time driving the tractor can be mainly attributed to the differences in the time spent on these activities. This large variability is probably due to the inborn differences between individuals, such as why some people are always late. However, the study suggests that some simple organisational changes will help the participants improve their situation. Each participant has the results from his own farm, indicating the direction in which to improve his performance.

Future work
The study has identified activities on the farm that consume considerable time. Unfortunately answers to improve many of these activities are not readily available. Several areas need further study. These include:

- Repairs. There is a need to identify whether the main problems with machinery are manufacturing and design problems, problems associated with farmer misadventure or normal wear and tear.
- Scarifier points. The time spent changing points could be improved by longer-wearing points and better methods of changing points.
- Seed and fertiliser handling. The time spent handling fertiliser and seed may be reduced by better shed layout, faster output from bulk bins, greater combine capacity and better designed equipment.
- Spraying. There is a need for bigger capacity booms, better design, improved methods of getting water to the boom, and methods of improving the quality of farm water for spraying.
- Organisation. Training in organisation and management may improve efficiency on many farms. The form of training needs investigation.