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# 'THE OVERDRILLING OF PASTURES

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## INTRODUCTION

The overdrilling of pastures is a mechanical method of placing the seed, and usually the fertiliser also, directly into the soil, as distinct from the accepted practice of broadcasting on the pasture surface with or without previous surface cultivation.

One of the first points I wish to make is that much of the rapid deterioration of our pastures is due to poor seedbed preparation and a poor sowing down technique. I feel that we still have much to learn about the principles and art of good pasture establishment and am convinced that the useful life of our pastures could be considerably extended if this aspect of our farming was more thoroughly done.

Secondly, where pasture deterioration occurs the reasons must first be sought. Has it been due to faulty management, poor drainage, lack of fertilisers or lime, or to grass grub, or were the species or proportions sown unsuitable for the particular conditions? Unless the cause is found and corrected subsequent deterioration will follow the same pattern.

Thirdly, because of the wide range of conditions of soil, climate and pasture composition experienced in New Zealand the results achieved from overdrilling in any one place may not be applicable outside that area, or for that matter in the same area under a different set of conditions. This is why a proper understanding of the underlying principles is so necessary.

It is the object of this paper not to boost overdrilling but to try to assess its proper place from the results achieved to date.

## SUMMARY OF RESULTS

Generally speaking the overdrilling of clovers into native cloverless swards has been very successful, especially in regions of low rainfall such as the Mackenzie Plains in South Canterbury. The first overdrilling trials were laid down there in October 1948 and the results have been outstanding. Then again some very

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good results have been obtained from the overdrilling of short rotation ryegrass into clover dominant pastures, while the overdrilling of ryegrass on drought stricken pastures has usually been attended by good results. The oversowing of poor run out pastures with grasses and clovers has in the main been unsuccessful; The results from trials at Winchmore indicate that the overdrilling of lucerne stands with short rotation ryegrass offers a means of exploiting the nitrogen reserves of this crop and of appreciably extending the productive life of a lucerne stand either as a haying proposition or possibly for grazing. So far as the overdrilling of pastures with cereals for autumn or summer supplementary feed is concerned the results with the limited number of trials carried out in this country to date have not been encouraging.

#### UNDERLYING PRINCIPLES

At this point let us distinguish between the differences in nature of the clover plant and the grass plant. In general they establish most successfully at the opposite extremes of fertility. Clovers establish best in a pure grass sward (low nitrogen status) and grasses in a clover dominant sward (high nitrogen status). The problems of establishment increase as we depart from these two extremes.

Unlike a prepared seedbed, the pasture sward as a seedbed is a very variable thing. Only at best does it approach anything like the quality of the prepared seedbed for grass. In oversowing then we are attempting to establish seedlings amongst a mature population of plants. The situation that arises is not hard to imagine and is simply this. We have seedlings with undeveloped root systems and foliage trying to compete with mature plants for moisture, food and light. The struggle is indeed unequal. For this reason unless the existing sward is weakened in some way by drought, hard grazing and surface working of some kind the seedlings will have little chance of survival. I have seen on a number of occasions where excellent strikes have failed completely. In other words the seedlings have had a starvation seedbed, virtually in the midst of plenty. Under other conditions sward competition can be almost negligible.

Every species varies in its rate of establishment. In general annuals and non-permanent species such as subterranean clover and short rotation ryegrass are quicker than perennials such as perennial ryegrass and cocksfoot.

For each and every species, then, there is a critical

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level in a given set of ecological circumstances, above which the opposing forces are too great for the seedlings to survive. This establishment barrier is by no means fixed but is in a constant state of flux and is influenced most strongly by the prevailing weather conditions.

Through experience and experiment we have learned how to minimise the effects of this competition very considerably. Depending on what is being sown, the type of sward and the nature of the country the following recommendations can be made :

#### INTRODUCING GRASSES INTO CLOVER DOMINANT PASTURES

- (a) **Time of Sowing.** Sow when the grasses are at their lowest ebb. That is in the late summer-early autumn period. Conditions following a drought are ideal.
- (b) **Grazing Management.** Hard graze immediately before sowing. On sheep country heavy stocking over a period or successive hard grazings with big mobs is very effective. Grazing after sowing and before the seedlings are sufficiently advanced to be affected has much to recommend it.
- (c) **Subsequent Treatment.** A good initial establishment of grass can be harmed considerably by grazing too soon. Short rotation ryegrass should not be grazed till at least 6in. in height and perennial ryegrass till 3in.-4in. in height unless the existing sward threatens to outgrow them. On a dairy farm strip-grazing should be practised and on a sheep farm large mobs for short periods should be used but in no case should the grass be eaten off too hard.

#### INTRODUCING CLOVERS INTO CLOVERLESS OR VIRTUALLY CLOVERLESS SWARDS

- (a) **Time of Sowing.** Much will depend on the climatic conditions. In the colder regions of the South Island early spring sowing has given the best results but in warmer climates autumn sowing is usually regarded as the optimum time. However, early spring sowing is certainly worth investigation.
- (b) **Grazing Management.** Graze hard before oversowing.

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(c) **Subsequent Treatment.** Grazing should be lenient. Under such hard conditions the competition from the sward is usually not very great but where competition threatens the area should be grazed immediately and preferably with large mobs for short periods, but not hard, until well established.

#### INTRODUCING CLOVERS INTO SOWN PASTURES

Very little work has been done on this aspect of overdrilling. However following the initial strike in autumn or early spring success will depend largely on the extent to which the other sward species can be effectively controlled by grazing during the autumn to early summer period when the climatic conditions favour grass growth and secondly, and this is equally important, whether the area can be spelled at some stage from early summer onwards to allow the clover to reach mature size during this period when conditions are the most favourable for its growth..

Where moisture supply, soil phosphate, or bird damage become limiting factors in establishment the case for overdrilling as against broadcasting is strengthened.

#### INTRODUCING GRASSES AND CLOVERS TOGETHER

As both the conditions required and the subsequent management of clovers and grasses are almost directly opposite it stands to reason that in general it is not good policy to attempt to **OVERSOW** both species together. It would be better to establish the clovers first; then, when the fertility has been raised sufficiently, sow the grasses. Under conditions of higher fertility the clovers could be sown in the spring and the grasses the following autumn.

#### COMPARISON OF RESULTS FROM BROADCASTING AND OVERDRILLING

Surface broadcasting without cultivation is an old established practice but except under very favourable conditions has given poor results.

The fundamental requirements for successful over-sowing are :

- (1) A quick, even, and certain strike; and
- (2) Rapid establishment.

Overdrilling favours the first while broadcasting on a well cultivated surface often favours the second because of the reduced competition resulting from the removal of the existing pasture plants. So far as the

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strike and establishment of the sown species are concerned the results from broadcasting on a worked surface tend to be in proportion to the amount of cultivation done. The results however are **very** variable and depend on the soil type, (some soils responding more than others to surface working) moisture status, and above all the degree of turfiness of the sward. It will be readily appreciated that under some conditions it is very difficult to work up anything approaching a satisfactory seedbed at such short notice. Surface trash is often a real problem especially in swards containing twitches such as browntop and paspalum. Seed which falls on this trash, on plants that are still intact, or is not effectively covered (especially if the weather that follows is not favourable), have a poor chance of striking and establishing. So that, provided the over-drilling technique is sound, the actual strike from surface cultivation is seldom likely to be as good unless the surface cultivation **is** practically complete. However here we are really dealing with pasture renewal.

#### SOME ADVANTAGES OF OVERDRILLING

Some of the more important advantages of overdrilling are as follows:

- (1) **Reduction in per acre expenditure.** Due to economy in seed used, and in operational costs.
- (2) **Saving in time.** Because of this and the reduction in per acre costs one has the time to do, and can afford to do, a greater area of the farm at any one time.
- (3) **Reduced risk.** If surface working is fairly drastic and the results are poor, as has often been the case, the end result may be worse than what we started with, due to the loss of species and the possibility of increasing the weed content. With overdrilling on the other hand the pasture is left practically intact. This is a practical angle that appeals to the farmer.
- (4) **Fewer Weeds.** Surface cultivation encourages weeds and these may be troublesome ones such as docks and buttercup. On land known to be weedy in the non-cropping areas of higher rainfall where there is not the same chance to clean the ground by cultivation there might well be a case for pasture maintenance or improvement by pre-spraying for weeds followed by overdrilling to fill in the gaps, rather than complete pasture renewal.

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(5) **There is a minimum of damage to the existing sward.** Any form of surface cultivation tends to reduce the plant population of the existing sward. For instance in the Massey College-Grasslands trial carried out last autumn, in which short rotation ryegrass was introduced into a clover dominant sward, the amount of clover left in the sward after treatment was approximately 30% of the total pasture constituents for the over-drilled plots, 19% of the total for light cultivation, and only 4% for heavy cultivation. The light cultivation treatment consisted of one stroke of weighted spiked-tyne harrows plus the chain harrows to cover the seed while the heavy cultivation treatment consisted of three tandem discings (full cut) and once over with weighted spiked-tyne harrows, the seed also being covered with the chain harrows. There are four very real advantages arising out of the above in favour of over-drilling.

1. Areas can be closed up immediately after over-sowing for autumn-saved feed without any fear of suppressing the clovers. I should like to mention here that the wide spaces between the drills allows the limited light during the autumn-spring period to play fully on the clover leaf in contrast to the overall shading effects of a broadcast sowing.

2. Due to the abundance of clover the overdrilled pasture is practically insured against nitrogen deficiency or "spring yellows" in the early spring. In the Massey College-Grasslands trial both the heavy and the light cultivation treatments were suffering quite obviously from these effects this spring.

3. Any red clover present has a good chance of survival.

4. The pasture is better balanced as regards clovers and grasses.

5. The chances of pugging are greatly reduced.

6. Fertiliser placement is superior to broadcast-ing and is of special significance where clovers are being sown on phosphate deficient country. There is incidentally probable reduction in phosphate fixation.

#### TECHNIQUE OF OVERDRILLING

The ideal overdrilling machine for all conditions has probably not yet been produced. The measure of efficiency mechanically may be gauged by the extent to which it will place the seed and manure below the surface, on a firm undisturbed bottom, and at an even and readily adjustable depth. For efficient sowing, es-

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pecially on an uneven surface, a machine must have the independent coulter action of a drill.

It is not likely that the basic principles in design will alter much :—the disc coulter, the hoe coulter with a special penetrating point or a combination of the two. But in my opinion there is still room for modifications and adaptations to suit particular sets of circumstances. Valuable contributions to date are the incorporation of hydraulic lift action for clearing obstacles on rough country ; the skid on the disc coulter to limit and regulate depth of sowing; individual scrapers attached behind the penetrating points to give a more positive and precise covering of the seed under both wet and dry conditions.

The disc principle can be used almost anywhere and is especially valuable on a surface that is difficult to penetrate or has hidden obstacles. For stony land on the other hand discs are unsuitable. Here semi-rigid penetrating tynes and implements such as the Australian sod-seeder would appear to be particularly suitable.

However, in spite of all that has been said above, almost any farmer with implements can, with a little time and ingenuity or enquiry, equip himself with an overdrilling machine capable of doing a satisfactory job. For example a disc-seeder can be constructed from an old set of horse harrows or the front gang of tandem discs, plus a grass-seed box and some rubber tubing, etc., to lead the seed down to each disc separately. If he has a drill he can fit it with Grasslands tips, but for stony land I consider that narrow lucerne points are superior. However very stony land is rather hard on a drill, especially under dry conditions, so that machines of rugged design are best. On Canterbury farms where the cultivator is a standard implement a very satisfactory home-made machine could be constructed by using the narrow lucerne points on the cultivator, but these points may have to be set at a blunter angle than normally, and mounting a standard grain drill grass-seed box directly above it. This could be worked either off the cultivator wheel or from the tractor wheel itself. The seed could be led down behind the tynes by rubber tubes. If a fertiliser box could also be added then this would be an excellent set-up.

With regard to covering the seed it is usually advisable to do this. Under dry conditions the harrows can be attached directly to the implement. Harrowing under moister conditions should be done as a separate operation after the disturbed soil dries out later on in the day.

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## THE REMAINING CHALLENGE : SWARD COMPETITION

I have already said that overdrilling has largely overcome the strike difficulty. However competition from the existing sward is still a problem. This competition has two effects:

- (1) Causes death of seedlings through reducing available moisture, plant food and light.
- (2) Retards development, resulting in weakly plants that contribute little to production or may subsequently die out altogether.

The underground competition is often the direct cause of early deaths and the significance of this factor is evident in many ways. For instance it will readily be seen on close observation that the interior walls of the drilled-in surfaces become rapidly lined with an extensive network of root hairs emanating from the existing species in the immediate vicinity as soon as the soil is moist enough. Even in the weaker swards competition has its effects. This can be verified by observation in almost any overdrilled field, where it will be observed that development is usually much more rapid where there have previously been bare patches. In actual fact, then, it is the competition given by the plants immediately adjacent to the establishing seedlings that is the main obstacle. As opposed to the indiscriminate removal of species from the existing sward by either *discing* or *pitchpole harrowing* etc. a more logical approach would appear to be to have some form of *band* or *ribbon cultivation* of approximately say two inches in width. This effect could be obtained either by lateral soil displacement such as with the Australian sod-seeder with its wide shoe, or through entire removal of the strip, or by disintegration. To take full advantage of the situation I consider that the placement of the seed and fertiliser should be precisely along the centre-line of the band and positively placed there. Another possibility would be to produce an undercut seedbed obtained by fitting flanges to the hoe *coulter* point or *tyne shoe* to sever the roots of the plants in the immediate vicinity. Mr Cross of Massey has suggested the possibility of using flanges, and I consider this line of thought well worthwhile investigating. The advantage would be an absolute minimum of sward destruction. Another method of obtaining a similar effect would be by the use of two discs meeting at the front 'with their convex surfaces together.

The above suggestions are placed before you for

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something to think, about. The objective is **mechanically** possible but the practicability angle requires **p r o o f** .

A second line of approach to the problem would be from the chemical angle-the use of either pasture growth inhibitors such as **maleic** hydrazide by **pre**-spraying to quell the grasses and perhaps also with the idea of producing clover dominance, or by the use of materials to selectively reduce the aggressiveness of certain species in the sward, such as **browntop** or **pas-palum**. That this effect can be produced has already been demonstrated in the Flock Hill trials in North Canterbury where overdrilled clover on a dominantly **browntop** sward established more quickly where T.C.A. had been applied.

I would make no claim that the use -of chemicals is a practical and economical way out of our difficulties. I would say however that this avenue is worth watching and investigating experimentally. After all there is much yet to be discovered in the chemical field.

To my way of thinking **any** success that might be achieved in overcoming the competition in our more aggressive swards would open up the field for **overdrilling** for the specific purpose of maintaining pastures at the optimum level. In other wrdcs of reinforcing the desirable plant population in advance of actual losses. That is, getting in ahead of the weeds.

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#### DISCUSSION

- Q. Is it essential to cover the seed?  
A. Normally the seed is covered by using harrows. Clover does not require to be sown deeply-a mere cut with a straight disc is sufficient.

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- Q. Should the furrow be closed in quickly ?
- A. It is disadvantageous to try to close up the incision too early. If the incision is closed up too early ideal conditions are given for the growth of the existing sward as the root hairs of the grasses either side of the incision can quickly take up nutrients from the soil again. The competitive effect from the existing sward can be very real. In one experiment sulphate of ammonia was applied at the time of overdrilling perennial ryegrass in 7in. rows. The fertiliser encouraged the growth of the whole area, thus increasing the competitive effect of the existing sward.
- Q. Has any consideration been given to the idea of increasing the width of the groove from 2 to 3 inches?
- A. It is preferable to do the minimum amount of damage to the sward except in certain cases e.g. renovation of paspalum pastures: which require drastic treatment. The aim in over-drilling is to find a way of not damaging the sward, but severing the roots of the grasses either side. A new type of drill severs the roots of the grasses for half an inch either side of a 2in. furrow. This results in a 3in. reduction in competitive growth, but only a 2in. furrow.
- Q. With the direct introduction of the seed into the soil is it possible to reduce the normal seeding rates?
- A. Yes. Six pounds of viable seed per acre has given very good results.
- Q. What is the difference in the effect of the hoe and disc coulters for the elimination of local competition to young seedlings ?
- A. If the hoe coulters is used, the 2-2½inch gap takes very little time for the pasture to reknit. The greater concavity of the disc gives a better reduction in competitive growth than the hoe coulters.
- By overdrilling pastures you can definitely get around the farm very quickly, and certainly earlier than if the pastures were cultivated. Early sowings give better results than late sowings in Hawkes Bay district.