p 37-40. In: Hare, M.D.; Brock, J.L., editors. ***Producing Herbage Seeds.***
Grassland Research and Practice Series No. 2,
New Zealand Grassland Association, Palmerston North.

FACTORS AFFECTING SCALE OF ENTERPRISE

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Abstract. White clover is undersown in the spring with wheat, barley and peas. Irrigation is used in order to achieve a heavy flowering in the white clover crop over one month. Three barley crops must be grown successively in some paddocks to eliminate yarrow. Lupins, peas and soybeans are alternative legumes to white clover, but white clover is still the preferred legume to *grow*, especially with new cultivars becoming available.

Keywords: White clover, *Trifolium repens*, seed production, yarrow, alternative crops, overseas markets.

INTRODUCTION

The properties farmed consist of 689 ha of Lismore stony silt loams (30 cm depth of stone-free topsoil) situated in the Aylesbury-Burnham locality. Spray irrigating 80% of these properties (524 ha) coupled with white clover have played the important role in the transition from dryland-pastoral to high-yielding intensively-cropped units.

Water is applied on average at a rate of 65 mm every 18 days. Normally the area under white clover is around 150 ha, with yields of between 500-720 kg/ha. With these yields, plus lamb fattening on clover aftermath and the fertility buildup, white clover has been our most lucrative crop to grow.

SEED PRODUCTION

Rotation

A six year rotation of spring wheat — white clover — spring barley — white clover — peas — ½ with white clover and ½ to autumn sown ryegrass is practised. In the past high yielding white clover second crops were taken. However, over recent years the rapid yarrow (*Achillea millefolium*) buildup in these crops has eliminated this option from our rotation,

Time of sowing

'All clover is sown with cereal and pea crops, thereby eliminating the costs of establishment. Seed is broadcast at 3 kg/ha in 30 cm spacings from tubes positioned near ground level behind the coulters and cover harrowed. Earliest sowings are in July (wheat), August-September (barley), through up to late October (peas).

Fertiliser

Prior to sowing, fertiliser is broadcast at a rate of 450 kg/ha superphosphate mixed with 900 kg/ha lime. The amount of superphosphate applied has recently been doubled to offset a decline in soil sulphate to levels approaching yield limitation of 4 (MAF SO, test). No additional fertiliser is applied to clover at a later date.

Establishment success ,

Under short-straw barley cultivars and peas establishment has been very successful. However, nitrogen usage on wheat crops has prompted less favourable results. The occasional abandoned crop due to poor establishment and/or weed infestation is grazed through to land preparation for wheat, barley or peas next spring.

Grazing management

Immediately after harvest all clover, new and harvested, is irrigated, left for a fortnight to advance in growth then grazed. Grazing is relatively light at the start allowing continued clover growth to enable a longer turnover of store sheep. From April to July clover is grazed very hard trying to end up in July with virtually dirt paddocks.

The-stock-buying and selling policy is an important factor in minimising farm labour costs. With autumn buying, the increased stock management needs balance a fall-off in labour necessary for harvesting. Selling stock off-sets the build up in man hours required for land preparation then subsequently the crop spraying and sowing programme.

Weed control

Stock are removed to allow paddocks to freshen before spraying for grasses and broad-

leaved weeds, usually in July. Herbicides used are propryzamide at 0.9 kg ai/ha (Kerb 50W 1.7 kg/ha) with 2, 4-D butylester at 1 .1 kg ai/ha.

Closing date

As ground conditions allow, paddocks are heavy rolled in late winter/early spring to create a level surface for harvest.

All paddocks are closed for flowering after spraying — at the latest by mid August. This early closing is made possible through the development of a lesser herbage bulk on 30 cm spaced sowings. Growth is further restricted by the lack of additional fertiliser coupled with cool spring winds. Occassionally topping with a mower, up to mid November, has been used to control an over-dense stand. However, in most cases delay in water application has proved equally as effective in checking any undesirable early flush of growth.

Pollination

Bee hive density has been reduced from 3 to 1 hive/ha without any obvious effect on seed set.

Pests

Regardless of numbers, aphid and casebearer' moths are sprayed for. in early December with bromophos (Nexion). In the past sprayed compared to unsprayed crops gave the highest yields. The elimination of second year crops has led to a marked drop in numbers of casebearer moths present. As such, the merit of spraying all future crops is to be reviewed to try and cut costs.

Irrigation

To adequately service 524 ha under irrigation 5 side-roll and 3 *Rotorain* units are used. The 30 cm of topsoil overlying stone compared to other Lismore soils which contain a high proportion stone in the surface zone, allows the use of both lower amounts and a lesser frequency of water application. Normally irrigation is to the extent of getting at least two good flowerings off each crop. Depending on the season this usually entails three 25 mm applications at 14 day intervals. It has been noticed that if heavy flowering is achieved over one month a very good crop should result. The main period of flowering may vary from the last week in November to the last week in December, to as late as late January, with no great difference in yields. This gives greater flexibility in water budgeting, and spreads the length of time to harvest the crop. The only problem with the late crops is occasionally the difficulty of harvesting in early March; a limitation of both days and hours when the crop is fit.

Harvest

Seldom are crops harvested before the end of January. They tend to mature in order of time of sowing. Irrigation is used in some years to ensure spread in crop maturity; insufficient spread can cause higher seed losses through delay in harvest.

All crops are sprayed with the defoliant diquat (Reglone) three days prior to harvest. This is determined at a time when it is felt that the largest percentage of well filled heads are completely ripe and these are mainly the second and third flowerings. The first and later part of the third flowerings are usually poorly filled. Glyphosate (Roundup) has been successfully used in the odd couch infested crop; killing the couch and defoliating the clover. Glyphosate (Roundup) has to go on 10 days prior to harvest because of its slower burning effect. With our area of clover there is no option but to defoliate all crops or the area could not be managed. Harvesting takes six days, when crops come in close together.

All the clover is cut one way against crop lie with two 3.04 m windrowers. Two axial-flow headers, one fitted with two Murphy pickups (side by side) and the other with a single Murphy, harvest two and one windrow respectively. Under windy conditions all operations are carried out into the wind with minimum time between windrowing and heading. Under normal operating conditions, with two combines heading both ways, 2.4 hectares an hour can be harvested.

All clover seed is transported directly from paddock to the seed dressing plant by farm truck.

Fertility buildup

As already implied crops grown are classified on a basis of overall costs and returns for land preparation and the duration in the ground. Clover unlike our other crops produces seed, feed and then subsequent improvement of

cereal yields, Initially only lupins and peas were used in the rotation and were associated with unacceptable cereal yields by today's standards. With the transition to clover as the dominant legume in the rotation the average wheat yields on the farm 8 years ago (3.5 t/ha) have increased to 5.0 and 5.5 t/ha. These increases were gained in the absence of any major bag nitrogen inputs. Limited experience with wheat and barley cultivars released over the last two to three years indicate that further yield increases to 6-7 t/ha can be achieved.

Costs and returns

A major reduction in costs has come through minimising labour to two men plus two casual for a fortnight at harvest. Tractor and labour hours have been substantially reduced by using a dual-crop sowing system. Transporting seed directly from the paddock to the dressing plant has eliminated the capital cost of large scale on-farm storage. Proximity to a major livestock market (40 km), coupled with farm transport, provides a high level of flexibility to obtain good returns from stock fattening.

At the current price to the grower of $1.80/kg of dressed seed the net return/ha for white clover has slumped to be similar to that for cereals. Against a gross profit of $1200/ha must be equated spiralling costs such as $300/ha for seed dressing, $300/ha for sprays and $50/ha electricity for water. Over half the gross profit is eroded without even taking into account associated machinery, labour and land charges. To date the saving grace has been $400/ha nett for lamb fattening plus an additional 2 t/ha of cereals which would not have been possible without clover in the rotation.

FUTURE PROBLEMS

For many properties which have gone from dryland-pastoral to intensive mixed cropping with irrigation the ingress of yarrow has occurred at an alarming rate. This increase, in most cases, has been associated with the taking of good yielding second year white clover crops. Growing barley in a rotation on some of the worst affected paddocks is really eliminating the yarrow. The rotation starts with winter barley then burning, sowing a brassica for winter feed and then sowing spring barley for two years, undersowing the second crop with white clover.

At the same time the above rotation is achieving good yields of barley of around 6 t/ha through applying 125 kgs of urea per ha. At $60/ha for urea this is far more economic than being lumbered further by those ever increasing chemical costs. However, should breakdown in soil structure become a problem yarrow control using Versatill (2 l/ha) and minimum cultivation between peas and ryegrass may have to be considered.

The self-aggravated problems with yarrow have made us very aware of some of the bad weeds found in the traditional white clover seed areas. The large-scale autumn stock, buying policy makes us more prone to accidental introduction of weeds such as yellow gromwell ***(Amsinckia hispida)*** nipplewort ***(Lapsana communis)*** field madder ***(Sherardia arvensis)*** and catchfly (*Silene gallica*). To counter such a happening a constant surveillance is made for these weeds to both preserve certification grades and stop further escalation of the spray and seed dressing bills,

ALTERNATIVES

The possibility of further decline in the Huia price with the continual yearly increase of plains irrigation and thereby area taken for seed has led us to assess alternative crops.

As mentioned earlier to help eradicate yarrow three consecutive crops of barley have been grown with very good results using urea, but on the light to medium soils how long it could be continued without the soil break-down must be questioned. With long term barley growing the rate of urea and fertiliser would have to be increased substantially, eroding the net profit quite unacceptably.

Lupins are another alternative, but for seed the market is very limited and with modest yields have proved uneconomic to grow. The last crop of Ultra lupins harvested in 1982 were sold in October of 1984; this was not very helpful as far as the cash flow was concerned. Lupins or tick beans can, however, be very effectively used as a winter feed crop sown after harvest and grazed off before spring crops are sown. This system has a lot of merit and should be used more often in the rotation on arable farms.

Soybeans would fit very well into a rotation but as yet a suitable variety has not been bred to suit our temperatures. It is hoped

that in the not too distant future there is a variety that will suit the climate in Canterbury. There is a large market for soybean oil, together with the value of the New Zealand dollar, the oil could be sold very competitively against other countries.

However, overall, the opportunity to replace Huia with a more profitable alternative legume crop appears remote.

After mentioning some of the alternatives to white clover in the rotation, white clover is still the most efficient legume to grow for nitrogen fixation. Because of this the greatest future potential seems to lie in the growing of an alternative white clover cultivar which will command a higher price to the grower than Huia.

Clover Cultivars:

At present it is felt that the price differential between Huia and Pitau in relation to Pitau's lower yield does not warrant a change. By contrast the imminent release of Grasslands Tahora or the possibility of growing an overseas cuitivar which will give higher returns/kg of seed may be well worth considering. However, for many farmers, the risks in cultivar change appear to be very high. An inability to meet Ministry of Agriculture & Fisheries standards for crop purity and/or subsequent plot test of the resultant seedlines could be a costly exercise. Not only would the paddock be out of clover for from 3-5 years but the same problem then arises if one decides to go back to growing Huia. To justify this risk there must be proof that any new Grasslands or overseas cultivars released for multiplication are going to yield well and remain genetically stable in our environment; without this information farmers have lost before they start.

Of greatest concern is the apparent lack of adequate knowledge on fool-proof methods for changing from growing pure seed of one cultivar to that of another. To this end immediate attention must be addressed to speed up research in this area, which is vital to the continuing profitability of the large-scale intensive mixed cropping farmer.

In summary, in an intensive crop rotation as outlined in this paper, white clover continues to play an essential role in fertility and humus buildup of the soil. It is hoped that with aggressive marketing, rapid development of fail-safe methods for cultivar change coupled with the release of more profitable cultivars, white clover will be allowed to persist. in farm rotations as a more viable proposition than it is today.