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MAKU LOTUS SEED PRODUCTION IN PRACTISE

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Abstract

After 4 years practical experience in *growing* Maku *Lotus* seed crops and with the help of research, an establishment and management package has been developed that should ensure growers of more reliable seed yields than in the past. information on herbicide requirements, irrigation, pest control closing date, flowering, pollination and harvesting techniques are included. Nevertheless an analysis of gross margins based on a return of $12/kg suggests the return on investment is inadequate considering the high risks involved.

Keywords: Maku Lotus, *Lotus pedunculatus,* seed production, management, herbicides, harvesting, gross margin.

INTRODUCTION

Maku lotus *(Lotus pedunculatus* Cav, also known as *L. uliginosus)* is one of many herbage cultivars my wife and I grow on our 150ha, predominantly herbage seed producing farm at Dillons Point, Blenheim. Some cropping iscarried out, and stock, chiefly hoggets, play only a minor part as required to fit in with seed production management.

Maku lotus is a difficult, and risky crop to take for seed. The two main problems are in weed control, and harvest risk. The weed problem is probably due to Maku being naturally adapted to low fertility, low pH soil conditions and I am growing it on a high fertility, Taitupu sandy silt loam with a high pH of 6.2 +.

The first 4 ha sowing of Maku took place in the autumn of 1978, and since then the area has been increased to 22 ha. Machine dressed yields over four harvests since have been 125, 150,400 and 185 kg/ha.

During this time I have gathered all the research information on Maku that I could find around the country, and tried to put it together into the following practical package.

ESTABLISHMENT

I have successfully established Maku from both spring and autumn sowings, but prefer spring as a successful establishment is assured. Autumn sowing is more risky, but if successful can give a good return in the first year.

The proposed paddocks are sprayed in the autumn for couch (*Agropyron repens*) control with glyphosate at 2.2 kg active ingredient/ha ('Roundup' at 5L/ha), ploughed early in the winter, and cultivated thereafter as weed germination occurs. Above average cultivation is carried out to provide a firm fine seedbed. As Maku requires a higher than average soil temperature for germination, sowing is delayed until at least mid-October. This allows many clovers and weeds to germinate which can then be controlled by cultivation methods.

Immediately prior to sowing trifluralin at 1.0 kg ai/ha ('Treflan' 2.5L/ha)

be the acceptance by growers that with good management high yields can be consistently obtained, If these measures are not taken, then all New Zealand's lucerne seed is likely to be imported by 1990.

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is soil incorporated for pre-emergence weed control of annual grasses, and some broadleaf weeds. Seed is inoculated, and then sown, as shallow as possible at 2.5kg/ha, lightly harrowed in, and rolled. Immediately after sowing ethofumesate at 0.5kg ai/ha ('Nortron' 2.5L/ha), is sprayed to control germinated white clover. Maku is very slow to germinate, and it is usually 4 weeks before the first plants are seen. Once the plants have three true leaves 2,4–DB at 1.6 kg ai/ha (4L/ha), is sprayed to control broadleaf weeds that may have emerged.

Maku likes moisture especially in the establishment stage, and I find it beneficial to spray irrigate, with usually 5 waterings through to early autumn being applied.

MANAGEMENT

The management of the crop revolves around two factors. The understanding of the plant, and the delaying of harvest to coincide with more suitable harvest conditions.

Maku plants have a main tap-root leading from a crown from which stolons/rhizomes are produced. In many soil types these are rhizomes but on my harder soils they creep across the surface from early April until severe frosts occur. All along these stolon shoots, new stems, and new roots are formed, which should be encouraged as I believe it is from here that the main seed bearing stems develop. Hence on both new stands and established stands I keep stock off until early winter, as grazing in autumn when Maku appears particularly palatable to hoggets, may hinder stolon development.

WEED CONTROL ON ESTABLISHED STANDS

Many weeds and grasses can become established during the late autumn and winter period, and can seriously reduce seed yields.

If docks are predominant I spray with asulam at 1.4 kg ai/ha ('Asulox' 3.5L/ha) in autumn. Spring applications of this herbicide gives better results but affects the vigour of Maku. During mid-winter reasonable control of weeds and grasses can be obtained by spraying with a mixture of paraquat at 0.3 kg ai/ha (1.5L/ha) and atrazine at 0.75 kg ai/ha (1.5L/ha), with a wetting agent. I am suspicious however that these chemicals plus others that I have done trials with cause damage to the stolon system of Maku, and probably kill off the new plants leaving only the parent plant. This is an area where I feel more research is needed. The herbicide 'Goal' (oxyfluorfen) recently released has shown promise in my trials, giving reasonable control of a wide range of weeds, with little damage to the Maku plants.

When white clover becomes a problem in established stands, I spray in the early spring, usually the last week in August, with Nortron at 5L/ha, (ethofumesate 1.2 kg ai/ha) so as to coincide with the Maku spring growth during October. The Nortron takes about 5 weeks before it has any visual effect on the clover, and it is at this stage that the Maku needs to be in full growth, to smother out the sickly clover.

If Scotch, and winged thistles germinate in the early spring, 2,4-DB at 1.6 kg/ha (4L/ha) is used however, it does affect the growth of the Maku, and therefore should be applied no later than the end of September.

Perennial grasses, and in particularly couch can be a problem when they become well established. There are two new products 'Fusilade' (fluazifop-butyl) and 'Alloxol' (alloxydim-sodium) just released which showed particular promise in suppressing couch in trials I carried out last spring.

CLOSING TIME

Closing of stands, and management thereafter is done with several objectives in mind. I prefer peak flowering during the height of the summer when days are at their longest, and the honeybee is most active. I try to keep the bulk of the crop growth down so as to speed up harvest time and to delay harvest until the heat of summer has gone and more cool easterly weather occurs, usually about the end of February.

During spring prior to closing it is desirable to keep the canopy of the crop low to encourage the growth of the stolon stems. This is done either by grazing, or mowing.

Crops are closed for seed production about mid-October. Earlier closing gives a higher potential seed yield but results in a long flowering period from November to February, a very bulky crop to put through the harvester and an increased shatter problem. Late closing reduces the amount of growth but causes a marked decrease in seed yield.

IRRIGATION

I aim for a compact flowering period throughout January, however this can only be achieved by a combination of the closing date, and controlled irrigation, The plant must be kept growing through the spring, and early summer period as any early moisture stress will promote early flowering. This is where irrigation management plays a vital part, and it is usually necessary to irrigate my stands once every 2 weeks from November until the end of December. On my soil type no further waterings have proved beneficial and only promote vegetative growth which is undesirable.

PEST CONTROL AND POLLINATION

The potato bug (*Calocoris norvegicus*), is the main pest problem. From mid-October regular inspections of the crop at least once a week with a sweep net is needed. Once the numbers build up to 5 bugs per 20 sweeps, I spray with bromaphos at 0.6 kg/ha which has proved to be the most effective insecticide. For good control two sprayings are normally required. The first in mid-November, and the second the end of December. Particular care is taken to ensure that the chemical is sprayed only in the late evening so as not to effect the bee population. Keeping the bees alive and active is probably more important than killing the bugs. I use 2.5 beehives/ha.

HARVESTING

Harvesting of Maku seed is a risky business. Maku seeds are contained in pods which nature has designed to explode when ripe, especially during hot weather conditions.

The most difficult management decision is to know at what stage to cut a crop for harvest. I endeavour to do so when 70+ % of the pods are ripe, and still have their seeds within. To achieve this it is necessary to sacrifice pods on both ends of the ripening scale. If the pod is not ripe when cut, the seed will shrivel up and be worthless. So pods must be ripe but not have shattered when cut. For a pod to be ripe it must be changing on the underside from a green to yellowish brown colour, and must snap cleanly when broken between the fingers. The seed must be turning from green to yellow, and must not be able to be squashed.

When the crop is ready it is cut with a bottom driven 4 disc type mower. When driven at the correct ground speed and r.p.m. this mower does not cause shattering, and allows the tangled, stalky crop to be cut easily, and quickly. Once cut the pods are even more susceptible to shattering, and must be harvested as soon as possible. This creates a problem as the seed is ripe but the stalks are still green, long and tangled. After my first experience with harvesting Maku I found it necessary to purchase a larger harvester so that the crop could be put through earlier and quicker, and thus a larger area could be grown.

I aim to harvest the crop 3 days after cutting, but often find it necessary to leave it for a few days longer. The harvester must be ready, and waiting to go as soon as conditions are right. If a crop gets wet while in the wind row much seed can be lost during drying. In such cases I turn the wind row with a finger wheeled rake as soon as drying commences to allow the tangled bottom to dry. This is the only time I turn the wind row, as each time it is moved, seed is lost.

During the harvest the headers concave is left well open as most of the seed is thrashed even before it gets to the cylinder. The cylinder is run about 1000 r.p.m. and the draught onto the sieves is cut well back.

SEED DRESSING

After harvest the seed is taken to the dressing shed where it is cleaned by an aspirator, and riddling machine. Seed is then run on a spiral separator which is very effective at separating round lotus seed from shrivelled lotus seed, and seed of white clover, grass, thistles and other seed that is not round.

The seed is then scarified and is ready for marketing. Scarification is necessary to obtain a good germination. Lines of Maku seed with up to 55% hard seed have been reduced to 2% hard seed after scarifying. All my seed is certified, and usually has a germination of above 90% with a thousand seed weight of over 0.75 grams. I market my seed directly to the user.

GROSS MARGIN

The Gross Margin is calculated over a 40 month, 3 season period with no harvest during the first season and 2 harvests each of 200kgs/ha taken the following two seasons. (Table 1)

All costs shown are farmer costs with my own machinery, not contractors rates. An interest rate of 15% per annum is charged on a month to month basis as the expenses must be met by the farmer when they occur. Payment for seed does not occur until after spring purchase (October).

Because of the problems and high risk associated with growing and harvesting lotus seed, I consider a gross margin of around $1500/ha is necessary, or around double that for my wheat crop. On present average yields of 200kg/ha (Table 2) shows a price of $16/kg would be necessary to achieve this and the current price of $12/kg would not be adequate. From this it is clear that my next step must be to substantially increase my average yield, only then will a lower price be acceptable.

INVESTMENT

A Maku seed crop is an expensive crop to grow with the grower having to wait up to 30 months before getting a return on his first seasonal investment.

To be able to grow this seed crop reliably, and successfully it is important to have the neccessary machinery available, and "ready to go" so that each individual

Table 1. MAKU LOTUS SEED CROP CALENDER, COSTS AND GROSS MARGIN OVER 3 YEARS

Year	Month	Activity	cost ($/ha)	interest (15%/an.)	Income ($/ha)
1	April	Roundup @6L/ha	170	63.90	
	July +	Cultivation 9hrs/ha @ $14.50/hr	130	40.75	
	Sept.	Seed 2.5kg/ha @ $30/kg	75	23.50	
	Oct.	Treflan @2.5L/ha	32	27.12	
		Nortron @ 2.5L/ha	58		
	Nov.	2,4D–B @ 4L/ha	35	10.12	
	Dec. +	5 irrigations @ 66mm/ha each	25	6.82	
		TOTAL	525	172.21	
2	Oct.	2,4D–B @ 5L/ha	40	6.00	
	Dec. +	3 irrigation @125mm/ha each	30	3.37	
		2 x Bromophos @ 0.6L/ha	40	5.00	
	Feb.	Mowing 1.5hrs @ $14.50/hr	22	2.20	
	March	Harvesting 1.5hrs @ $95/hr	142	12.42	
		TOTAL	274	28.99	
3	April	Asulox @3.5L/ha	58	4.35	
	May	Seeddressing @ $1 .OO/kg	200	12.50	
	July	Paraquat @ 1.5L/ha	44	1.65	
		Atrazine @1.5L/ha			
	Sept.	Nortron @6L/ha	125	1.56	
		2,4D–B @5L/ha	40	0.50	
	Oct.	Payment 200kg @ $12/kg			2400
	Nov.	Fusilade @ 2L/ha	100	12.50	
	Dec. +	3 irrigation @125mm/ha each	30	3.37	
		2 x Bromophos @ 0.6L/ha	40	4.50	
	March	Mowing 1.5hrs/ha @ $14.50/hr	22	1.92	
		Harvesting 1.5hrs/ha @ $95/hr	142	12.42	
4	May	Seed Dressing 200kg @ $1 .00/kg	200	12.50	
	Oct.	Payment 200kg @ $12/kg			2400
		TOTAL	1001	67.77	
		GRAND TOTAL (including interest)	2069		4800
		GROSS MARGIN (3 years)	$2731		
		GROSS MARGIN (per season)	$910/ha		

Table 2. Gross Margin for Maku lotus seed.

Seed Yield (kg/ha)	Gross Margin ($/ha) @.. $8/kg	$10/kg	$12/kg	$14/kg	$16/kg
150	140	340	540	740	940
200	380	640	910	1180	1440
250	610	940	1280	1610	1940
300	840	1240	1640	2040	2440

management operation can be carried out at the correct time. This means having a large capital investment in cultivation, spray irrigation, and especially harvesting equipment. Indeed an understanding Bank Manager is very necessary in being able to grow this crop successfully.

CONCLUSION

Lotus Maku has a tremendous future in land development both in New Zealand and overseas. Its ability to grow on low fertility acid soil on a wide range of topography from sealevel to 5000 ft along with the fact that it is bloat free, grass grub resistant, and requires less phosphate than other legumes makes it indeed a wonderful plant.

Seed production has been very slow to establish and this has hindered the extensive use of this species in land development. The problems associated with the crop are now being overcome, and seed producers can now look forward to more reliable seed yields.

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