EFFICIENCY AND QUALITY IN THE PRODUCTION OF SWEET LUPIN

Erik von Baer

Semillas Baer, Casilla 87-Temuco

Corresponding author's email: info@semillasbaer.cl

ABSTRACT

The competition with other energy crops has caused a drop of the production area assigned to lupin in Chile. Nevertheless, the comparison of production costs shows a higher profitability of the lupin. A higher profitability has been achieved with winter varieties, with high quality through winter production with determinate growth. The crop is profitable only where protein plus oil content is the determinate of the price. The spring *L. mutabilis* reaches the target protein and oil content. Under drought conditions *L .angustifolius* shows the best performance. The determinant factor is the yield of protein plus oil per hectare and their comparative production costs.

KEYWORDS

Lupinus albus, Lupinus mutabilis, Lupinus angustifolius, protein and oil content

INTRODUCTION

The worldwide energy crisis has caused a rise in the price of oil seed grain and subsequently cereal prices. This situation has brought about a huge increase in production costs and finally the consequent increase in food prices. The increase of oil seeds and later of cereals prices, in Chile, has caused the replacement of lupin production by canola and wheat, mainly because lupin price has not increased as fast as the other crops. This situation reduced the sweet lupin production not only in extension, but it has also made a change of its use from salmon feeding complement, to export product for human consumption. Nevertheless, the fertiliser price rise which has been stronger than the rising prices of grain is pushing up the interest in lupin production for the next season.

INFORMATION ABOUT THE GRAIN AND FERTILISER MARKET

The figures show that the strongest rise was of phosphate (Table 1 and Table 2), which increased its price four times in the last three years. Urea price increased 2.5 times. Both fertilisers have produced a considerable production costs increase in the production of oilseed and cereals. In the south of Chile it is considered that phosphate fertilisation is between 150 and 200 P2O5/hectare and nitrogen between 150 and 250 kg/ha. If we compare the costs in tons by product, canola and wheat are only profitable with high yields, whereas oats and lupin are very profitable, even with the average yield.

The lower cost of production of lupin (Table 3 and Table 4) can be explained mainly by the low fertiliser requirements, given that its capacity to mobilise phosphorus from the soil by its proteoid roots and to fix nitrogen from the atmosphere (Borie, F., 1990).

This is possible because in the soils of the south of Chile have reported total P contents ranging from 1150 to 3000 ppm and 1400 to more than 4000 ppm in unfertilised and fertilised soils, respectively (Borie and Zunino, 1983), P total method of hipobromito according to Dick and Tabatabai, 1977 (cited by Borie, F., 1990). If we compare the cost in tons by product, canola and wheat are only profitable with high yields. On the contrary, oats and lupin are very profitable, even with average yield.

THE RISE OF WHEAT PRICES

For wheat importing in Chile there is an extra shipping cost of USD 50/ton over international FOB Prices. This year the total import cost of wheat raised to USD 400/ton. Wheat imports in Chile represent between 20 and 40% of the total internal needs.

Table 1. Relation of prices of fertilisers in US dollars (prices of May each year in USD/ton).

Product	2006	2007	2007	2006	2007	2008
				% of variation		
Superhosphate	326	498	1.265	0	52.7	288
Monoammoniumphosphate	403	586	1.528	0	45.4	279
Urea	384	488	947	0	27.1	146

(Source: SQMC, Temuco-Chile.)

IN J.A. Palta and J.B. Berger (eds). 2008. 'Lupins for Health and Wealth' Proceedings of the 12th International Lupin Conference, 14-18 Sept. 2008, Fremantle, Western Australia. International Lupin Association, Canterbury, New Zealand. ISBN 0-86476-153-8.

Table 2. Prices of May per year in US dollar per m/ton.

Year	Wheat Hard Red Winter FOB Gulf of USA	Bread wheat FOB Argentinian port	TRIPSFOS
2006	206	161	326
2007	203	209	498
2008	355	354	1265

Source: Revista del Campo (3).

Table 3. Direct cost per crop (USD/hectare) including financial cost and leasing.

Crop	Fertiliser	Seed	Agro-chemical	Fuel	Financing	TOTAL
Canola	1392	72	219	335	202	2220
Wheat	1179	135	216	273	180	1983
Oat	648	76	46	193	96	1059
Lupin	48	101	76	264	49	538

Table 4. Relative cost benefit.

Crop	Value (USD/t)	Direct cost (USD/ha)	Cost in ton (t/ha)	Statistical average yield (t/ha)	Good year (t/ha)
Canola	650	2220	3,415	3,836	4,5
Wheat	400	1983	4,957	4,77	6,0
Oat	280	1059	3,782	4,17	5,5
Lupin	400	538	1,345	2,50	3,0

Source: INE – VII Censo Nacional Agropecuario y Forestal 2006-2007 Resultados Preliminares Gobierno de Chile Ministerio de Agricultura. Note: If we compare the cost in tons by product, canola and wheat are only profitable with high yields. On the contrary, oats and lupin are very profitable, even with average yield. For wheat importing in Chile there is an extra shipping cost of USD 50/Ton over international FOB Prices.

Table 5. Spring sowing (August 2007). Plot yield, results 2007-2008.

Specie	Variety or line	Growing type	Ton/ha	Protein DM	Oil DM	% of Alkaloids
L. albus	E-5-61	Indeterminate	3,02	40,80	9,90	0,038
	E-5-62	Indeterminate	3,02	40,20	11,10	0,0171
	E-5-69	Determinate	2,60	42,20	10,80	0,0264
	Average		2,88	41,00	10,60	
L. mutabilis	E-1-9	Indeterminate	3,77	46,60	14,30	0,0109
	E-1-10	Indeterminate	3,12	46,60	15,00	0,0109
	E-2-14	Indeterminate	3,50	48,50	15,00	0,0264
	E-2-18	Indeterminate	2,50	50,10	1640	0,1550
	E-3-21	Indeterminate	1,87	47,60	14,80	0,0605
	Average		3,39	47,80	15,10	
L. angustifolius	Gungurru	Indeterminate	4,30	31,00	8,30	0,0372
	Walab	Indeterminate	4,70	32,50	6,40	0,0310
	Mandelup	Indeterminate	4,30	30,60	8,00	0,0403
	L-8-viola	Indeterminate	5,30	32,70	8,60	0,0279
	Average		4,65	31,70	7,80	

Table 6. Potential Profit by species. Soy meal Price content of 47% Protein = USD 520/ton Canola oil Price = USD 1600/ton 1% of protein = USD1,1 1% of oil = USD1,6.

Species	Protein content DM	Oil content DM	Ton value	Ton/ha DM	US/ha
L. albus	41%	10,60%			
Yield per %	451	169,6	620	2.592	1,607
L. mutabilis	47,80%	15,10%			
Yield per %	525,8	241,6	767,4	3.051	2,341
L. angustifolius	31,70%	7,80%			
Yield per %	348,7	124,8	473,5	4.185	1,981

* It is considered 10% moisture average. Note: in order to find the potential profit of the different species we multiply the current price of protein and oil by the average yield.

POSSIBILITIES OF THE LUPIN

If we consider lupin value based on its content of protein and oil according Baer, 2005, the situation changes favourably for lupin, in major or minor degree according to the species. In order to make calculations, it is taken as base of protein the value of the imported soy meal with 47% content of protein of USD 520/ton. Therefore the value of 1% of protein is USD 1.1. In case of oil, we took the value of canola oil, USD 1,600/ton; therefore the value of 1% of oil is USD 1.6.

Out of this result we can see the determinate types in case of *L. albus* show a 16% lower yield, being the difference with *L. mutabilis* of 50-60%. Nevertheless and considering the early and uniform maturity of the determinate types, we are trying to increase yields through higher sowing density of determinate type.

Winter *Lupinus albus*, contains on wet basis 35% of Protein x 1.1 = USD 385/ton having 9% oil content which adds additional value; 9% of Oil x 1.6 = USD 144/ton Total Ton Value = USD 529/ton. Consequently based on the previous information the direct production cost of lupin would be covered with a yield of 1.55 ton/hectare in 2008-09. In reality these values are smaller, because these values must be considered as ex-work prices plus all additional transport and milling costs. According to the previous analysis we can see that we do not have to increase only yield, which in leguminous is not easy, but also the content and relation of protein and oil of this yield.

POSSIBILITIES OF THE LUPIN OF SPRING SOWING

In order to check the situation, we analysed the results of our yield trials of last season 2007-2008 (Table 5). From these results we can see that determinate types in case of *L. albus* show a 16% lower yield being the difference with *L. mutabilis* of 50-26%.

The most profitable species would be *Lupinus mutabilis*, followed by *L. angustifolius* and then *L. albus* (Table 6). However, the results of *L. mutabilis* must be taken with care, since the results only correspond to the yields of one season, because in previous years it had not been possible to obtain sweet lines, and also which reached uniform maturity.

Therefore, we must spend at least two trial seasons more until we can recommend this species for commercial production. Until now, we must indicate that threshing is much more difficult in *L. mutabilis* because its grain has a very thin hull, which gets damaged easily by threshing. On the other side, it must be indicated that *L. mutabilis* does not resist temperatures below -4ºC and linked to photoperiod from spring to winter (October to July) in the southern Hemisphere and not autumn to summer, similar to the mediterraean species. When sown too late its vegetative development gets accelerated. Considering all these facts, we still must get more information and experience, before being able to send this new species abroad, as it has been demonstrated in work carried out previously in Europe and South America.

RESULTS AND DISCUSSION

Given phosphates price rising which quadruplicated and nitrogen which almost quadruplicated, lupin production started to be seen with a great potential of economic development in the coming future. Yield security is essential to make possible the expansion of the crop. New varieties of the different species especially *L. mutabilis* allow waiting for a greater yield of protein and oil by hectare.

L. mutabilis still offers insecurity to be considered as an important crop. This is an aspect that we expect to improve in the future.

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