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JOJOBA

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JOJOBA

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Jojoba* (pronounced hohoba) is a hardy shrub that produces seeds about the size of peanuts which are often referred to as beans or nuts. The beans contain about 50 per cent of a unique liquid wax, often called "oil". This is pure and remarkably stable with a multitude of potential uses. Worldwide interest has been shown in its use as a replacement for sperm whale oil.

Jojoba may grow up to 5 m high and live for more than 100 years.

Information on the production and commercial use of jojoba is very limited and actual commercial plantation experience even more limited. Market demand and ultimate prices are largely speculative.

Despite these uncertainties it is attracting widespread attention and enthusiasm in SA. Its production costs should be lower in SA than in most overseas countries where it is often grown on high-cost irrigated land.

The uncertainties surrounding jojoba make it a high-risk crop. Farmers and others interested should plant modest trial areas.

Recommendations are made in the light of existing information and may change with experience.

POTENTIAL USES

Lubricants: Jojoba oil is a superior lubricant for high-speed, high-temperature and extreme pressure applications and as a cutting, grading and transformer oil.

Cosmetics: As a base for face creams, lipsticks, tanning lotions, insect repellants, hair oil and shampoo.

Pharmaceuticals: As a carrier or coating for medicinal preparations, an anti-foaming agent, stabilizer for antibiotics, and it is a potential treatment for skin ailments. The meal contains an appetite depressant.

Factice: A potential for linoleum manufacture, printing ink, varnishes and chewing gum.

Polishing waxes: For cars, floors, furniture and vinyl.

Solvent: Of polyethylene.

MARKET CONSIDERATIONS

Research has demonstrated that jojoba is the best product known for many of 15 potential uses.

However it is not established as the product preferred by industry. This is likely to happen only when it is available in quantity at a competitive price and is effectively promoted. There is understandable hesitancy among manufacturers to use jojoba until a steady source of supply is assured. When supplies of sperm whale oil were phased out in the USA (because of prohibition of imports) there was a 25 000-tonne annual market which jojoba oil could have filled had it been available, and at a similar price to that of sperm whale oil (60 to 90c a kg). However since it was not available US industry developed alternatives which, although inferior in quality, were marginally acceptable but most importantly were priced in the sperm whale oil range (jojoba oil was priced at around 10 times sperm oil price range).

World production of jojoba oil is probably less than 50 tonnes a year, almost solely from hand-harvested nuts from wild shrubs in the desert regions of North America. Most enthusiasm for jojoba oil has been for its use as a substitute for the world's dwindling supplies of sperm whale oil – likely to become non-existent around 1990. Current production is about 120 000 tonnes a year and it is now worth about $1.10 a kg. This market could be secured for jojoba oil if it is available, at competitive prices. It is not, however, the only potential high-quality substitute, just the best at present. Other plant products are being investigated. It would be a mistake to think of the jojoba market as based only on its use as a substitute for sperm oil, for even at its largest this is a small market by agricultural standards.

In Australia around 8 000 tonnes of sperm whale oil is used a year currently worth about $8 m. Assuming yields of 2 tonnes a hectare and a 50 per cent oil extraction rate it would be possible for 8 000 hectares of jojoba to supply the Australian market.

The most economically attractive markets are the small-volume, high-price ones now being supplied by beeswax and natural waxes such as carnauba, which are used as highly-specialized lubricants.

The current limited supply of jojoba oil is used for these most specialized applications and the price being obtained is high, up to $20 a kg. Australia imports a number of natural high-grade waxes worth about $300 000 a year. It should be possible for jojoba to capture some of this market. To attract a large market jojoba must compete in price with common natural oils and synthetic waxes.

Appendix 1 indicates the price-quantity-quality relationships of the products with which jojoba must compete. It indicates that, as larger supplies become available from new plantations, jojoba

Simonondsia chinensis

will be forced to compete with lower-price products.

In the longer term jojoba nuts are not expected to be worth more than 50c a kg (nuts are about 50 per cent oil).

COSTS AND RETURNS

Many of the published accounts of the economic potential of jojoba production over-estimate the possible returns and under-estimate the probable difficulties.

Three factors control profitability: production costs, crop yields and market prices. All three are unknown because commercial plantation experience and supply and demand are very limited. The following comments indicate the possibilities.

Profitability: To assess the possible profitability of investing in jojoba production several assumptions are made. First that yields of 2 000 kg a hectare are possible in SA under rainfed conditions. Overseas research experience indicates that this is very conservative. Yields ranging from 1 to 10 kg a shrub have been reported. Secondly, that production can be mechanized. Costs of mechanically planting, pruning and harvesting jojoba are unknown but they have been estimated on the basis of costs for other similar crops. Thirdly, it is assumed that jojoba oil will be the product preferred by industry as the replacement for sperm whale oil and that it will also have a wide range of other uses, resulting in the prices being attained as shown in Appendix 1. These prices are based on the forecasts of the US workers Stubblefield and Wright.

Table 1 presents a summary of the estimated costs and returns for 1 ha of jojoba established in 1979. Details of the costs shown are given in appendices 3, 4 and 5. This shows a positive cash flow and profit after year 3. Assuming a 30-year life of the project and a salvage value of $5 000 a ha the internal rate of return (IRR) is 17.32 per cent (IRR is one measure of the average annual rate of return on capital invested for the life of the project). This is extremely attractive when compared with a 5 per cent interest charge for borrowing in a non-inflationary situation as assumed in table 1.

Table 2 presents today's estimated costs and returns calculated at the lowest likely price of 50c a kg. Break even is not achieved until year six. Assuming a 30-year life of the project and a salvage value of $5 000 this gives an IRR of 7.1 per cent which is only marginally attractive when compared to the interest rate of 5 per cent and indicates the advantages of early establishment of plantations despite the present lack of experience and knowledge.

Table 1: Estimated costs and returns of one hectare of jojoba (established in 1979).

Year	0 1979	1 1980	2 1981	3 1982	4 1983	5 1984	6 1985	7 1986	8 1987	9 1988	10 1989	11 1990	12 1991	13 1992
Yield (kg/ha)	–	–	–	500	800	1500	2000	2000	2000	2000	2000	2000	2000	2000
Price ($/kg)	8.00	6.00	4.00	2.00	1.80	1.60	1.40	1.20	1.00	0.80	0.80	0.80	0.50	0.50
Annual revenue ($)	–	–	–	1000	1440	1400	2100	2400	2000	1600	1600	1600	1000	1000
Costs														
Establishment	3720	150	550											
Operating				330	330	330	330	330	330	330	330	330	330	330
Overheads	77	77	77	77	77	77	77	77	77	77	77	77	77	77
Total annual costs	3797	227	627	407	407	407	407	407	407	407	407	407	407	407
Net cash flow	-3797	-227	-627	593	1033	1193	1693	1993	1593	1193	1193	1193	593	593

Table 2: Estimated costs and returns of one hectare of jojoba (established after prices stabilize).

Year	0	1	2	3	4	5	6	7	8	9	10
Yield (kg/ha)	–	–	–	500	800	1000	1500	2000	2000	2000	2000
Price ($/kg)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Annual revenue ($)	–	–	–	250	400	500	750	1000	1000	1000	1000
Costs											
Establishment	3720	150	550								
Operating				330	330	330	330	330	330	330	330
Overheads	77	77	77	77	77	77	77	77	77	77	77
Net cash flow	-227	-627	-407	-157	-7	93	343	593	593	593	593

CLIMATIC REQUIREMENTS

Jojoba occurs naturally in the Sonoran Desert and Baja California regions of south-western USA and northern Mexico. It is tolerant of hot, arid conditions but sensitive to frosts below 5°C which can damage flowers and the terminal portions of young branches. Frost will cause more damage after the end of July because it will prevent a second flowering which occurs to replace damage caused by earlier frosts.

In the wild the best stands of jojoba occur in areas where the rainfall is from 275 to 350 mm. In SA areas with a rainfall of 350 to 500 mm (predominantly winter) are recommended for trial plantings. Supplementary irrigation is unlikely to produce economic yield responses in the 350 to 500 mm rainfall zone and is necessary only during establishment.

The climate of much of SA cereal sheep zone, where the rainfall exceeds 350 mm, appears suitable for jojoba. It is expected that Yorke and Eyre Peninsulas as well as areas of the lower Murray will prove the most suitable areas of SA.

SOIL REQUIREMENTS

The soil requirements for jojoba are much more specific than the climatic requirements. It grows mainly on deep soils with gravelly or sandy texture, which are well drained and allow water to enter readily.

Poorly-drained soils, clays and clay loams, shallow soils with impervious layers closer than 1 m to the surface, hard-setting soils and very acidic soils (pH 5.0 or less) are unsuitable.

Jojoba is very salt-tolerant provided drainage is good. However, most saline soils in SA are poorly drained and are therefore not suitable.

Soil fertility is not critical. Responses have been obtained to nitrogen and phosphorus in pot experiments but not in the field. This is attributed to the deep, extensive root system which is able to exploit large volumes of soil.

Soils in the cereal-sheep zone which should be suitable include sandy and loamy red-brown earths, sandy mallee soils, deep loamy mallee soils, grey mallee soils and some calcareous sands.

Unsuitable soils include the duplex soils with a sharp texture contrast between topsoil and subsoil, e.g. solodized solonetz and podzolic, shallow soils and dark clay soils (Bay of Biscay).

PRODUCTION

Establishment and subsequent management involve initial over-planting with three times the number of shrubs eventually required. After initial flowering, in around three years, plants are sexed and the excess male plants are rogued (selectively removed) along with any obviously low-producing female plants.

Seeds or seedlings may be planted in the autumn or spring. Experience indicates more reliable establishment can be obtained by planting seedlings but better persistance can be expected from direct seeding because this allows unhindered taproot development. A list of suppliers is given in appendix 2.

Row widths should be enough to allow easy access of machinery for mowing, pruning and harvesting. A 5 m row spacing is recommended with plants spaced 1 m apart in the row, forming a "hedgerow". To achieve this plants are established 30 cm apart. After removing excess males and culled females and some natural losses this will give a plant about every metre. This plan requires 6 660 seedlings a ha, which is reduced to 2 200 ha, 2 000 of which are females.

HARVESTING AND PROCESSING

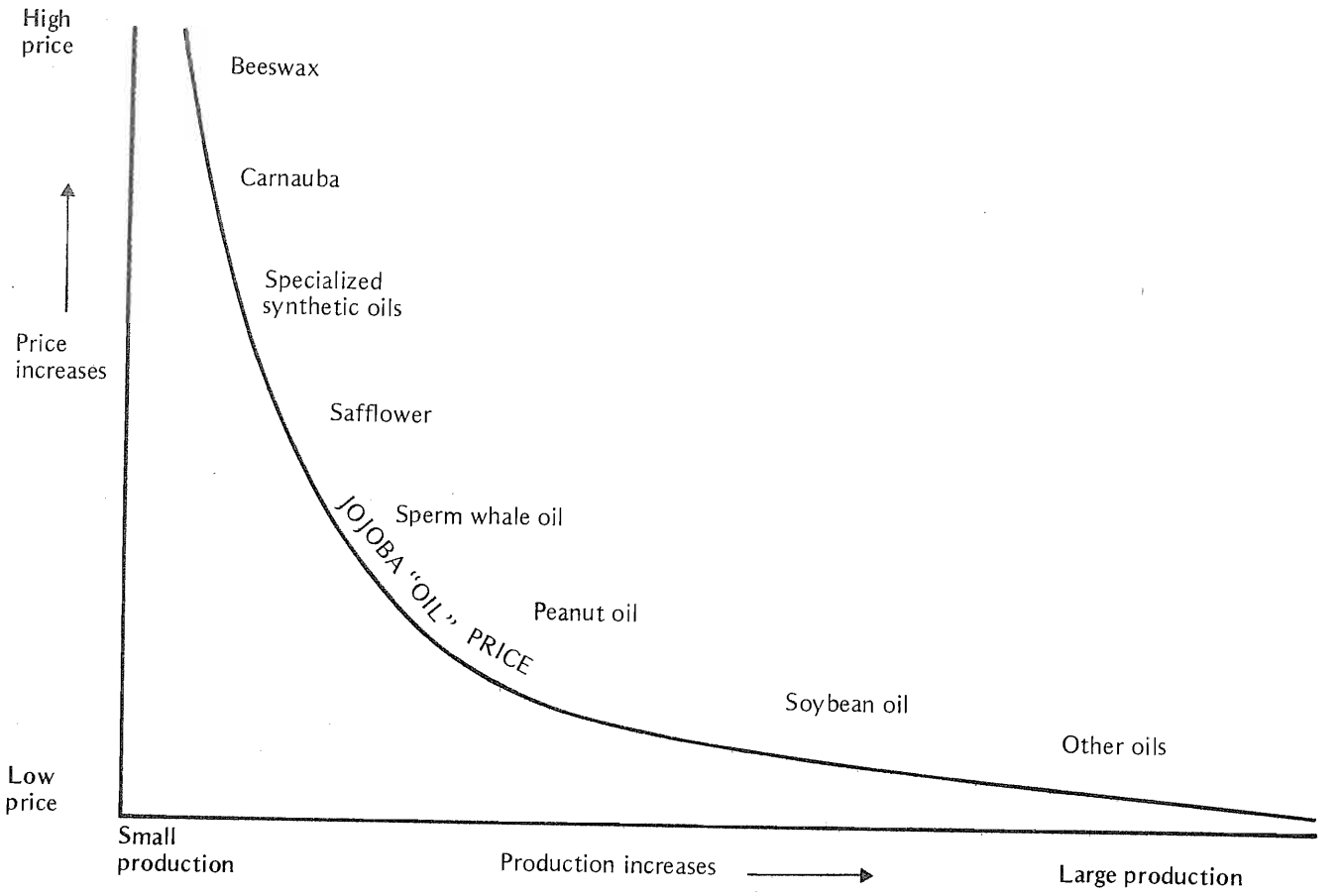
Mechanical harvesting of jojoba nuts has not yet been developed but it is not expected to prove particularly difficult. Nuts drop on the ground at maturity and could be collected using a broom or suction pick up. Shaker-type harvesters will probably not be suitable because of likely damage to the bushes.

Jojoba seeds can be processed using conventional vegetable oil-processing equipment either by crushing or solvent extraction as used with soybeans.

PESTS AND DISEASES

Wild populations of jojoba in desert areas do not suffer from major pests or diseases, but it is likely some problems will occur in plantations. Overseas experience suggests rodents and cattle can severely damage or kill plants by grazing.

Appendix 1:
Probable market price-quantity relationship of products with which jojoba could compete.



Appendix 2:
South Australian suppliers of seeds and seedlings of jojoba

Adelaide Jojoba Supplies,
8/20 Addison Road,
BLACK FOREST 5035
Tel: 297 4755

Mr. Ray Collins,
P.O. Box 130,
BRIGHTON 5048
Tel: 298 1999

Mr. David Potter,
Tukinya Nursery,
Ackland Hill Road,
COROMANDEL VALLEY 5051
Tel: 278 5944

Mr. L.C. Radford,
RENMARK WEST 5341
Tel: (085) 85 3311

Appendix 3:
Jojoba estimated establishment costs, 1 ha

	Year 1 $	Year 2 $	Year 3 $
Cost of land	300		
Land preparation	50		
Layout	50		
Seedlings, 6 600 @ 35c/ea	2 310		
Planting out seedlings using mechanical planter	660		
Watering, with water @ $150/ha each watering	300	150	—
Pest control	50	50	50
Roguing — excess males			500
	$3 720	$150	$550

Total costs for establishment: $4 420 a hectare.

N.B. — Direct seeding would reduce establishment costs. Planting fewer seedlings and roguing fewer males would reduce costs but may reduce potential yield of seeds.

Costs are at likely contract rates.

Appendix 4:
Jojoba production — estimated annual operating costs a hectare

Machine pruning (hedgerow)	$80
Weed control, chemical and/or mowing	$50
Roguing low-producing female plants	$50
Machine-harvesting and seed cleaning	$150
Total annual operation costs	$330

Costs are at likely contract rates.

Appendix 5:
Jojoba production — probable overhead costs a hectare

Accountancy, phone and post	$50
Council rates	$6
Registrations and insurances	$3
Workers' compensation	$18
	$77

Other costs excluded because machinery operation costed at contract rates.