SOME IMPORTANT ON-FARM COSTS OF SPECIALIST GRASS SEED PRODUCTION IN SOUTH-EASTERN QUEENSLAND

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ABSTRACT

An analysis of important costs of specialist grass seed production shows the major cost items to be fertilizer (particularly nitrogen fertilizer) and harvesting. Higher yields offer the greatest scope for reducing total costs per kilogram which are dominated by field costs particularly where yields are relatively low. The implications of these points are discussed.

INTRODUCTION

Although research on genetic and agronomic aspects of tropical pasture seed production has been carried out in Queensland for a number of years, the price of many seeds remains high. Factors such as instability in both export and domestic markets have contributed to high seed prices. However, the fact remains that seed of many tropical pasture species is expensive to produce because the plants themselves have been selected primarily for their attributes in grazed environments and may not produce heavy, well-synchronized crops of seed. In wild plant populations, reproductive strategies have resulted from natural selection for survival and, at this early stage in the domestication of tropical pasture plants, there has been little, if any, modification of such strategies by man.

If total costs per kilogram are to be reduced, the underlying cost structure should be described and major cost items identified so that the effects of major variables in the system can be explored. Vicary (1970) estimated production costs for the tropical legumes, *Lablab purpureus*, *Glycine wightii*, and *Macroptilium atropurpureum*, in north Queensland, but we have not found any similar published estimates for tropical grass seed production. In this paper, we present an analysis of costs of specialist grass seed production in south-eastern Queensland. We have not attempted to estimate average cost of production for this industry, but, rather, have sought to highlight major cost items, effects of variations both in yield and in recovery during cleaning, and the scope for reducing total costs per kilogram.

ASSUMPTIONS

Our simple model recognizes the manner in which specialist seed crops of grasses such as *Setaria anceps* (setaria), *Chloris gayana* (Rhodes grass), and *Panicum maximum* cv. Gatton (Gatton panic) are grown and processed in the area. In this system, paddocks are deliberately managed to produce seed crops and fertilizer nitrogen is applied to maximise yields. The following assumptions were made.

(i) Two rain-grown crops are harvested each year, the first ripening in late spring or early summer and the second in late autumn.

(ii) Seed stands are established with 500 kg superphosphate, 125 kg potassium chloride, and 50 kg N (as urea) per hectare.

(iii) Annual maintenance dressings of superphosphate (250 kg ha^{-1}) and potassium chloride (50 kg ha^{-1}) are applied.

(iv) Each crop receives additionally either 100 or 150 kg N per hectare as urea. Maximum seed yields for post-establishment seed crops of many tropical grasses are commonly obtained using around 100 kg N ha^{-1} $crop^{-1}$ (Boonman 1973, Stillman and Tapsall 1976, Humphreys 1976), but this require-

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ment appears to be higher—at least 150 kg N ha^{-1} $crop^{-1}$—at least in the case of Narok setaria (Hacker and Jones 1971, Bahnisch 1975, D.S.L., unpublished data). Attention is therefore focused on the current technological optimum.

(v) Because seed markets have been notoriously unstable in the past, we adopted a finite life of five years for seed stands in our analysis. In practice, however, paddocks sown to perennial species should (in the absence of any long term decline in vigour) continue to crop indefinitely.

(vi) Costs used in deriving estimates for our analysis were based on those prevailing in early February 1977. Where available, we have used contract costs for farm operations (e.g. ploughing, slashing, fertilizing) to avoid arbitrary allocation of overheads; however, such decisions were unavoidable with seed drying.

We made no allowance for clearing or for other costs such as capital invested in land. We also made no assumptions about average yields per ha of cleaned seed, nor about percentage seed recovery, since all of these can vary widely.

BASIC COST DATA

Contract rates used in calculations are shown in Table 1.

TABLE 1

Schedule of contract rates

Operation	hrs ha^{-1}	Rate (\$ hr^{-1})	\$ ha^{-1}
Disc-ploughing—first	1·4	15	21
Disc-ploughing—second	1·1	15	16
Harrowing	0·3	15	5
Rolling and planting	1·0	15	15
Fertilizing	0·4	15	6
Slashing	1·0	15	15
Harvesting	1·7	25	42

Prices per tonne for fertilizer (based on tonne rate, ex Gympie) were: superphosphate, \$72; potassium chloride, \$138; and urea, \$168. Additional costs included seed for crop establishment (\$15 per ha), labour (4 hours per drying day at \$3 per hour), road and rail freight charges (5c per kg), administrative and storage charges (3c per kg), and 25 kg bags at 55c each (2c per kg) for Rhodes grass or 33c each (1c per kg) for other grasses. The cost of cleaning also differs according to species—Rhodes grass (27c per kg) and other grasses with denser, more freely flowing seeds (17c per kg)—and is charged on the uncleaned weight of seed.

To allocate drying costs, we assumed a theoretical enterprise using a dryer (capital cost: \$6,000) on 40 harvest days per year. Fuel consumption was 4 *l* diesel $hour^{-1}$ at 10.5c per litre. An annual allowance of 15% of capital cost was made to cover depreciation (7.5%) and overheads (7.5%). If each harvest day (of c. 6 hours) covers 3.5 ha, the drying cost is approximately \$9 per hectare.

FIELD COSTS

Costs of growing, harvesting, and drying the crop depend on the area involved and not on the weight of seed harvested, and are collectively referred to as "field costs". Vicary (1970) included drying in the equivalent of our processing costs; in practice, however, drying of moist seed commences as soon as possible after harvesting and we feel that it should be included in field costs.

Based on our foregoing assumptions and basic cost data, field costs per hectare (rounded to the nearest dollar) have been estimated as follows.

	$	$
Establishment		
First discing	21	
Second discing	16	
Harrowing	5	
Rolling and planting	15	
Seed	15	
Fertilizing	6	
Fertilizer	72	
Total establishment cost	$150	
Establishment cost per crop (2 crops year $^{-1}$, 5 year life)		15
Crop Maintenance		
Slashing	15	
Fertilizing	6	
Fertilizer: Urea (100 kg N ha $^{-1}$ crop $^{-1}$)	36	
Superphosphate and potassium chloride	12	
Total maintenance cost		69
Harvesting		42
Drying		9
Handling		3
Field costs per hectare		$138

If 150 kg N ha $^{-1}$ crop $^{-1}$ is used, urea costs an additional $18 and field costs per hectare are increased by about 13.0% to $156. However, with either 100 or 150 kg N ha $^{-1}$ crop $^{-1}$, the costs of buying and applying fertilizer and harvesting are the major cost items and collectively account for some 70% of field costs per hectare (Table 2).

TABLE 2

Percentage contribution to field costs per hectare

Operation	100 kg N ha $^{-1}$ crop $^{-1}$		150 kg N ha $^{-1}$ crop $^{-1}$	
Establishment	10·9		9·6	
Slashing	10·9		9·6	
Fertilizing	4·3	69·5 (Fertilizing to Harvesting)	3·8	73·1 (Fertilizing to Harvesting)
Urea	26·1		34·7	
Superphosphate and potassium chloride	8·7		7·7	
Harvesting	30·4		26·9	
Drying	6·5		5·8	
Handling	2·2		1·9	

The contribution of field costs (i.e. field costs per kilogram) to total costs per kilogram is markedly affected by the yield of clean seed, particularly at lower yields (Figure 1).

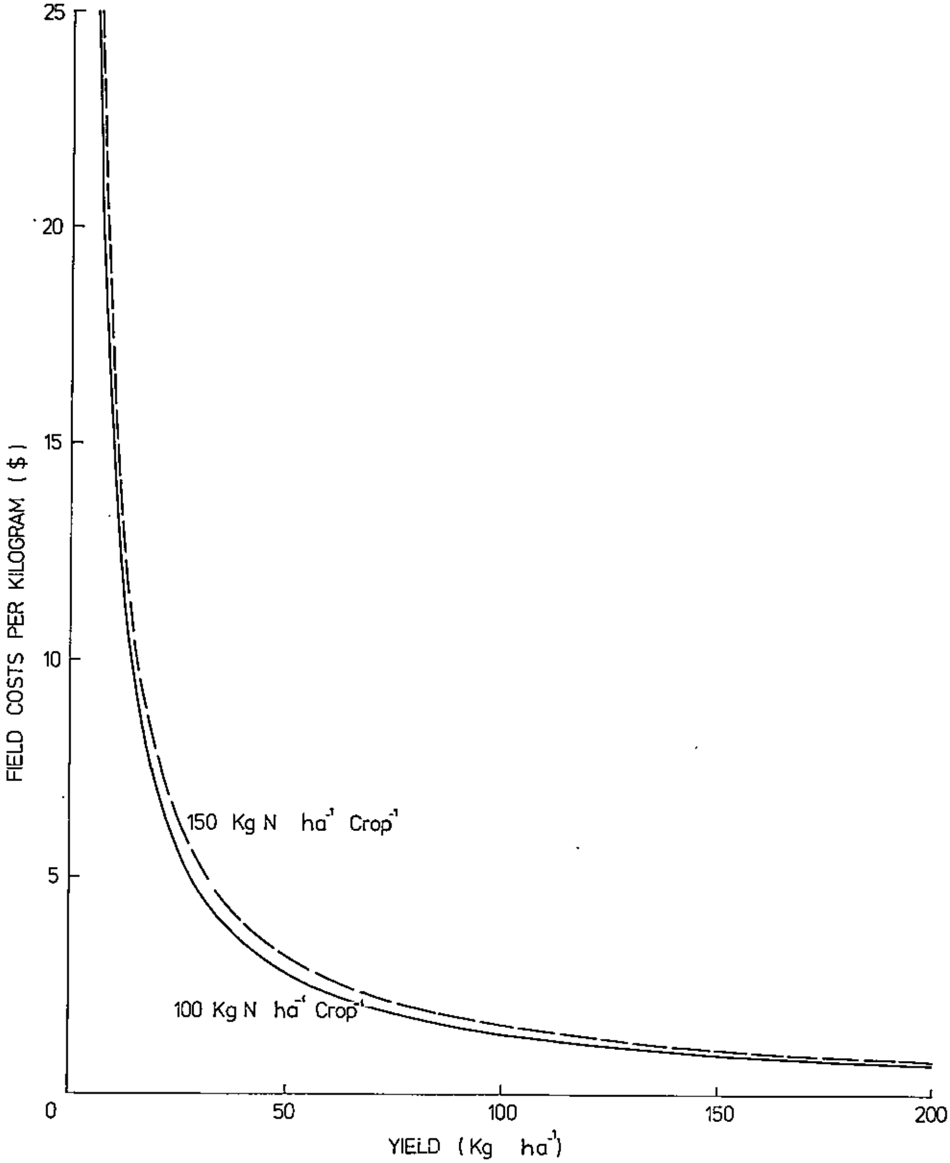

FIGURE 1
Effect of yield of cleaned seed on field costs per kilogram.

PROCESSING COSTS

Costs incurred after the crop is dried depend on the weight of seed harvested. These have been collectively referred to as "processing costs" and include freight, bags, cleaning, storage, and administrative overheads. Their contribution to total costs per kilogram is affected by percentage recovery of clean seed (Figure 2).

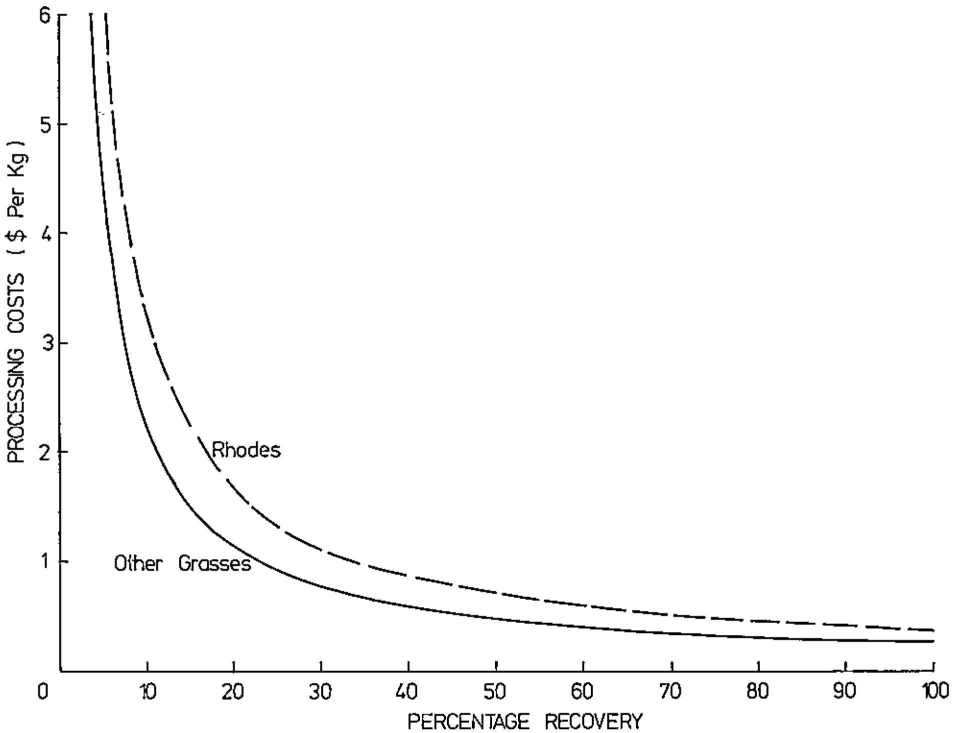

FIGURE 2
Effect of percentage recovery during cleaning on processing costs.

TOTAL COSTS PER KILOGRAM

In our model, total costs per kilogram are derived by the following equation:

Total costs per kilogram = Field costs per kilogram + Processing costs.

In Figure 3a, field costs per kilogram and processing costs have been combined in this way to show total costs per kilogram. For ease of presentation, however, only the case of 100 kg N ha^{-1} $crop^{-1}$ for grasses other than Rhodes grass has been considered.

Total costs per kilogram for specialist grass seed production are dominated by field costs and so are highly dependent on yield. Variations in recovery do not greatly affect total costs per kilogram, especially in the upper part of the recovery range where most commercial samples fit; the combination of a relatively high yield and a relatively low recovery rate is necessary before processing costs make any really marked contribution to total costs per kilogram (Figure 3b).

DISCUSSION

In specialist grass seed production, field costs per kilogram clearly dominate total costs per kilogram. Fertilizer (particularly nitrogen fertilizer) and harvesting are the major cost items, since the cost of buying and applying fertilizer and harvesting collectively account for some 70% of field costs per hectare (Table 2).

In recent years, fertilizer has become an even more important cost item than hitherto. Fertilizer prices rose faster than general farm costs during 1974 and 1975: between the December quarters of 1973 and 1975, the B.A.E. Index of Fertilizer Prices paid by farmers in Queensland rose by 91%; this compares with a rise of 49% over the same period for the B.A.E. Total Index of Prices paid by farmers in Queens-

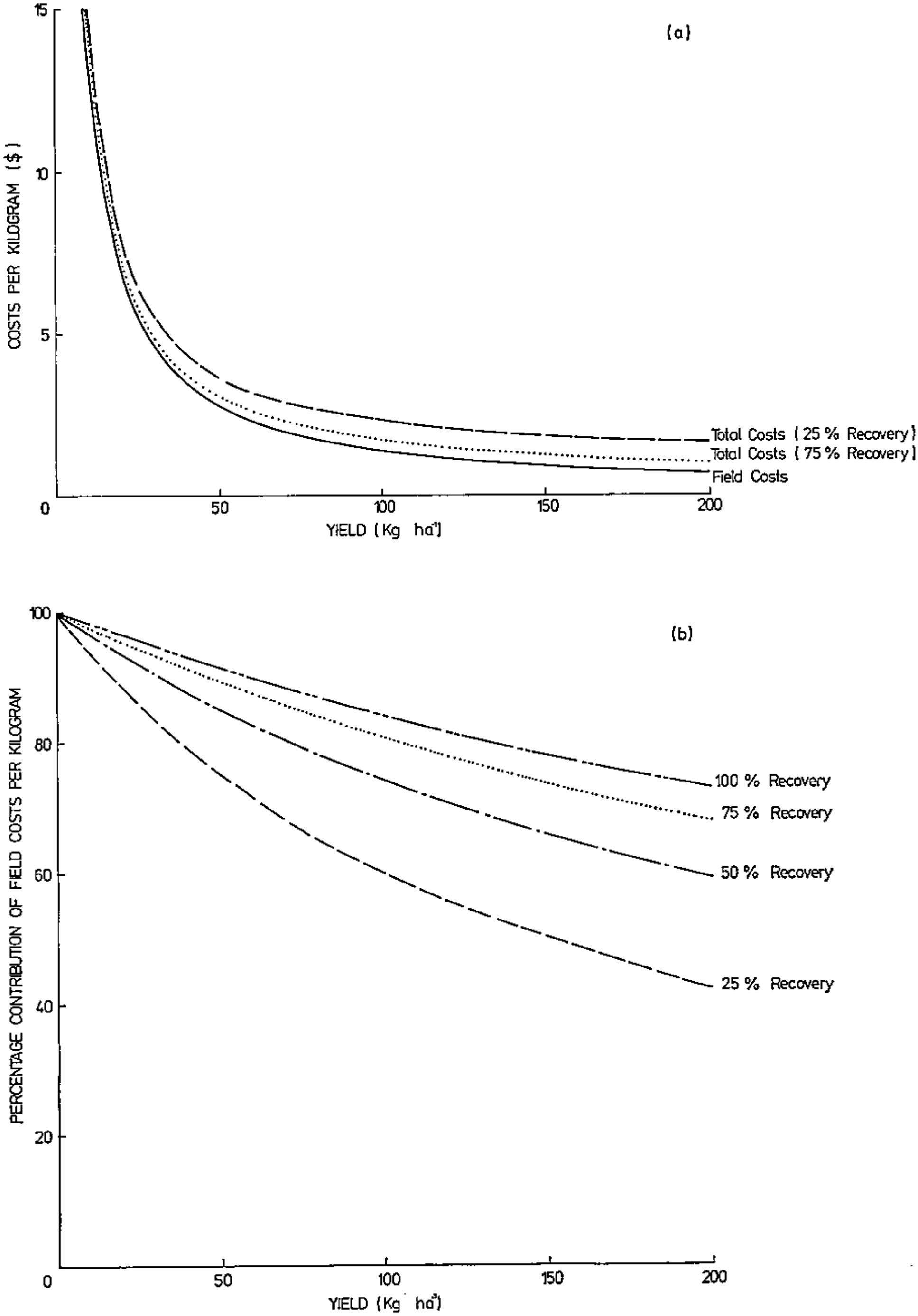

FIGURE 3

Effects of yield of cleaned seed on total costs per kilogram and percentage contribution of field costs per kilogram for grasses other than Rhodes grass with 100 kg N ha^{-1} $crop^{-1}$.

land. Fertilizer prices were relatively stable during 1976, but the situation in the future could be exacerbated by the progressive removal (which began on January 1, 1977) of the Commonwealth Government Farmers' Nitrogenous Subsidy.

Nitrogen is of paramount importance in determining the seed yield of tropical grasses, and its technological role in this regard has been recently reviewed by Humphreys (1974) and discussed by Boonman (1973), Javier, Siota and Mendoza (1975), and Humphreys (1976). With tropical grasses, increases in seed yield due to nitrogen are usually attributable to increases in inflorescence density (Javier, Siota and Mendoza 1975); in setaria, for example, the benefit is almost wholly through such increases in inflorescence density, but in most other species, smaller increases in inflorescence size also contribute (Humphreys 1976; D.S.L., unpublished data).

Fertilizer nitrogen has therefore become the main technological basis of specialist grass seed production. However, its use at around optimum levels at 100 or 150 kg N ha^{-1} $crop^{-1}$ contributes 26 or 35% respectively to field costs per hectare in our analysis. The only previous calculation of the direct cost of fertilizer nitrogen to tropical grass seed producers appears to be that made by Hacker and Jones (1971) on the basis of their results with C.P.I. 33452 setaria. Although fertilizer prices were very much lower then and harvest efficiency was not taken into account, they also found the cost of fertilizer nitrogen to be substantial.

Fertilizer nitrogen also adds to costs indirectly in the second major cost area, harvesting. The production of large quantities of green material in well-fertilized paddocks inevitably slows the speed of harvest by machinery designed to handle dry, stiff-strawed grain crops, not green and (possibly) tangled grass seed crops.

Higher yields offer the greatest scope for reducing total costs per kilogram. Our analysis shows that higher yields greatly reduce total costs per kilogram while lower yields catastrophically add to them, because they are dominated by field costs per kilogram (see Figure 3). Therefore, as field costs per hectare for this system do not vary substantially with species, seed of species and cultivars where relatively low yields are recovered (e.g. Narok setaria—Loch 1975) is more expensive to produce than seed of those with relatively high yields.

At this stage, much of our knowledge concerning management of specialist grass seed crops revolves around fertilizer nitrogen. Research to define nitrogen fertilizer response functions and to identify optimum rates is important to ensure the most efficient use of fertilizer nitrogen. However, current commercial yields show that, for many tropical grasses, nitrogen provides far from a complete answer. It does not always ensure high potential seed yields; and even where it does, large discrepancies may exist between potential and harvested yields. In some cases at least, it may be more sensible to work towards the presentation of an increased proportion of the crop at harvest or a higher efficiency of harvest than to aim for higher potential production. Harvested yields for any one cultivar can also vary widely (e.g. Loch 1975), and an understanding of the environmental factors involved could lead to lower variation and to increased average yields.

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