The economic loss caused by serrated tussock (*Nassella trichotoma*) in New South Wales

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SUMMARY

The economic impact of the weed serrated tussock (*Nassella trichotoma*) on the economy of New South Wales was estimated. The opportunity cost of replacing all serrated tussock in New South Wales with improved pasture was calculated at $12.2 million per year, based on the potential loss of wool production. The first year cost of replacing serrated tussock with improved pasture was $24.3 million. The benefit/cost ratio for controlling the weed over a 20 year period was 1.9:1, which represents a profitable investment for public funds.

INTRODUCTION

The annual loss of agricultural production caused by weeds in Australia is suspected to be substantial. This assumption is based on the heavy economic losses due to weeds in foreign countries (Fischer, 1968; Rogers, 1974).

While no attempt has been made to quantify the aggregate loss involved in Australia, estimates of the losses attributable to certain individual weeds have been made. For example, the Industries Assistance Commission (1976) estimated that loss in wheat production in N.S.W., Victoria, and South Australia due to skeleton weed (*Chondrilla juncea*) approximated $21.5 millions during 1972-73.

Weeds cause losses in two distinct situations; in crops and in pastures. In crops, the costs of weeds can be measured directly in terms of yield losses, and/or by the costs of the control inputs used (e.g. herbicides) and aggregated to determine their overall economic impact on the industry.

In pastures, it is more difficult to assess the cost of weeds mainly because the production losses caused by pasture weeds are difficult to determine. Also, there has been little data available on the extent and distribution of pasture weeds which prevented calculation of the aggregate production loss and the cost of control.

However a recent survey of weed control authorities in N.S.W. (Campbell, 1977) has provided data on the area infested and the distribution of three important pasture weeds: serrated tussock (*Nassella trichotoma*), St. John's wort (*Hypericum perforatum*) and sifton bush (*Cassinia arcuata*). In this paper estimates have been made of the cost of control, the losses in production and the benefits and costs of the long term control of one of these weeds (serrated tussock).

MATERIALS AND METHODS

The cost of controlling serrated tussock in N.S.W. was derived from the first year cost of replacing the weed with improved pasture on moderately heavily infested arable and non-arable land. Added to this was the cost of chipping and spot spraying all light infestations in N.S.W.

Annual production loss was calculated from the assumption that if all serrated tussock were replaced with improved pastures in N.S.W., wool production would be increased by 95% on previously heavily infested land, by 40% on previously moderately infested land and by 0% on previously lightly infested land.

Benefit/cost analysis was used to determine the profitability of the long term control of serrated tussock under pasture improvement.

The benefits were assumed to be the value of the increased greasy wool production which would result from replacing serrated tussock with improved pastures. This involved estimating the increased average stock numbers which could be carried on improved pastures and the degrees of tussock infestation for each individual shire. The assumed stocking levels were based on statistics issued by the Australian Bureau of Statistics and on the findings of Clinton et al, (1968).

The costs are assumed to be those of replacing the serrated tussock with improved pastures and the annual cost thereafter of superphosphate application and of chipping and spot spraying regenerating tussock seedlings.

The profitability of control was determined by expressing the present values (P.V.) of the stream of benefits and costs as a ratio. The N.P.V. was derived from the identity:

$$P.V. = \sum_{j=1}^{m} Aj/(1 + i)^{j} + (Am + 1/i)/(1 + i)^{m}$$

where the first term of the right hand side of the identity represents the discounted value of the unequal portion of the respective streams of benefits and costs, and the second term refers to the perpetual annuity (perpetuity) which results once the respective stream becomes stabilized. The benefits and costs were discounted at 10%.

The internal rate of return (that rate of discount which equates the present values of the streams of benefits and costs) was also calculated.

RESULTS

The first year cost of replacing all serrated tussock in N.S.W. was calculated to be $24.375 million (Table 1) while the annual opportunity cost of serrated tussock infestations was estimated at $12.22 million (Table 2).

The benefit/cost ratio for the long term control of serrated tussock was estimated to be 1.9:1 at a 10% rate of discount, indicating that each $1 spent on the control of weed would yield $1.9 of benefits assessed at present day value.

Table 1. The estimated cost of controlling serrated tussock in N.S.W.

Degree of infestation	Arability	Area infested (ha)	Current cost of control/ha ($/ha)	Estimated total cost of control ($ million)
heavy	arable	12031	65.00	0.782
heavy	non-arable	59169	110.00	6.509
moderate	arable	37213	65.00	2.419
moderate	non-arable	109887	110.00	12.087
light	arable	191452	5.00	0.957
light	non-arable	270248	6.00	1.621
		680000		24.375

Table 2. Estimated annual production loss in N.S.W. due to serrated tussock

Degree of infestation	Total area (ha)	Estimated loss of greasy wool production (million kg)	Estimated opportunity cost of production ($ million)
heavy	71160	4.209	6.663
medium	147060	3.506	5.557
		7.715	12.220

The estimated internal rate of return (29%) was greater than the assumed market rate of discount (10%).

DISCUSSION

Based on the benefit/cost ratio of 1.9:1 the long term control of serrated tussock represented a profitable investment proposition (Table 3). The benefits were estimated in terms of greasy wool production only and do not include the increased value of pasture improved land or the value of the removal of the threat of infestation to tussock-free areas. Inclusion of these benefits should significantly improve the ratio of estimated benefits to costs.

The costs may be similarly understated because the level of control envisaged in the reported estimates could only be feasibly undertaken under Government intervention; the extra costs of the administration, land purchases and implementation of the control program would have to be taken into account.

In calculating the first year cost of replacing serrated tussock with pasture it was assumed that pasture improvement was possible in all infested areas. However, some areas with low rainfall, infertile soil or rugged topography may not be suitable for

Table 3. Estimated benefits and costs of serrated tussock control in N.S.W. over a 20 year period*

	Year						
	1	2	3	4	5	. .	20
	$ million						
Costs	24.375	9.421	9.421	7.239	7.239	. .	6.020
P.V. at 10%	22.159	7.786	7.078	4.944	4.495	. .	0.895
Benefits	0	5.886	10.837	16.733	20.738	. .	20.738
P.V. at 10%	0	4.864	8.142	11.422	12.876	. .	3.082

* Benefit/Cost ratio: 1.9:1

Internal rate of return: 29%

normal pasture improvement. In some of these areas pastures could be established but grazing pressure would have to be so light to maintain pasture dominance that the investment may not be profitable. In other areas control could only be achieved by planting pine trees or allowing the country to naturally revert to the dominant native shrub or tree. If substantial areas were planted to pine trees the first year cost of controlling serrated tussock would be greater than $24.375 million. Also, if large areas were either sown to pastures that could only be grazed lightly or were allowed to naturally revert, the opportunity cost of controlling serrated tussock would be reduced as would the profitability of the benefit cost ratio. To provide accurate figures for these economic criteria we need to classify serrated tussock infestations according to the method of control that should be adopted.

REFERENCES

Campbell, M.H. (1977).- Area and distribution of serrated tussock (*Nassella trichotoma*), St.John's wort (*Hypericum perforatum*) and sifton bush (*Cassinia arcuata*) in New South Wales. N.S.W. Dept. of Agric. Tech. Bulletin 18.

Fischer, L.A. (1968).- Some economic aspects of pest control in Agriculture. *Canadian J. Agric. Econ.* 16 : 90-99.

Industries Assistance Commission (1976).- Financing Rural Research. Aust. Govt. Publishing Service, Canberra.

Rogers, E. (1974).- Weed Science today. *Weed Sci.* 22 : 464-8.

Vere, D.T. and Campbell, M.H. (1978).- Estimating the economic impact of serrated tussock (*Nassella trichotoma*) in New South Wales. Submitted to *J. Aust. Inst. Agric. Sci.*