FARMERS EVALUATION OF WEED AND INVERTEBRATE PEST PROBLEMS IN PASTURE

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SUMMARY

Twenty six pastoral farmers from both north east Otago and central Southland were interviewed to assess the importance of weeds and invertebrate pasture pests and adoption of control measures. Weed and pest control was ranked second to fourth on a priority order of six spending options. In north-east Otago, farmers spent 5.4% of gross margin (\$0.92/su) on weed and insect pest control, mainly on gorse, nodding thistle and barley grass. In central Southland, farmers spent 1.5% of gross margin (\$0.37/su) on control, mainly on Californian thistle, cutty grass and grass grub. Decisions to control weeds and pests were based on the cost of control and the availability of surplus funds. Farmers were reluctant to use pesticides, preferring biological control options. Regionally-based farm-sized trials at field days, with fact-sheet hand-outs, and short concise articles in farming magazines were favoured for technology transfer.

Keywords: survey, weeds, invertebrate pests, pasture, technology transfer.

INTRODUCTION

Although surveys associated with technology transfer to farmers, and farmer readership have been conducted (Lively and Nuthall 1983; AGB:McNair 1985 1986; Mohamed 1987; Gibbs 1970), little information is available on farmers' perceptions of the importance of weeds and pasture invertebrate pests, the most appropriate methods of information transfer, and methods of improving the adoption rate of control measures. To provide this information, 52 farmers were canvassed in two regions in southern New Zealand. This paper summarises the important points of the full report by Stuck and van Toor (1992).

METHODS

From farm location maps, 26 farmers were selected at random from 765 farms in north-east Otago which represented a region with low summer rain, and 26 farmers from 632 farms in central Southland which represented a region with reliable medium summer rain. Farmers were included in the survey, provided they met the criteria that no more than 5% of their land area was cropped, their main income was derived from farming, and farms were greater than 100 ha. Farmers were individually interviewed by R.J. Stuck (farm consultant) over one two-hour session during February and March 1992. Questions were read out to maintain uniformity, but clarification was given where appropriate. The information was requested for 1991. It consisted of an estimate of the degree of infestation, area affected and pasture loss from weeds and invertebrate pests on their property, farmer's knowledge of control options, how they decided to implement strategies, and preferences for technology transfer mechanisms. Financial details were obtained from the balance sheets. Farm production details and stock unit carrying capacity (Scott and Adam 1991) were also recorded. The value of each stock unit was estimated by dividing the farm gross margin by the total number of stock units. The value of the pasture/crop lost due to a particular weed or pest was calculated by

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multiplying the farmer's estimate of area lost by the ewe equivalent carrying capacity per ha and the dollar value of each ewe equivalent. Analysis of variance was performed on the data, with means between districts compared at the 95% confidence level.

RESULTS AND DISCUSSION

Income versus weed and insect pest expenditure

On average the productive area per farm was 338 ha, with 302 ha in pasture. Sheep accounted for 95% (SEM = 2.0) of animals carried, cattle 4% (SEM = 1.9), and deer and goats 1%. Stock carrying capacity for north-east Otago and Central Southland was 7.8 and 13.5 ewe equivalents/ha (SED_(df=25) = 0.9), valued at \$24.7 and \$28.3/su (SED = 3.1) or \$194 and \$378/ha (SED = 42.6), respectively.

In 1991, farmers from both districts spent \$5.21/ha (SEM=0.75) on control of weeds and \$0.33/ha (SEM=0.16) on control of pasture insect pests, but they estimated that they would need to spend \$9.30/ha (SEM = 1.18) to adequately control all weed and insect pests. Farmers in north-east Otago spent 5.4% of gross margin on weed control, while those in central Southland spent 1.5% (SED = 1.45), equivalent to \$0.92 and \$0.37 per stock unit (SED = 0.21), respectively. The amount spent on control of insect pests was negligible.

TABLE 1: Farmer estimates of the status⁺ of their most important (>0.1 ha pasture loss) weed and insect pests, area of pasture loss from weeds and the calculated mean value of land lost from production.

Weed-pest	District	Status ⁺ (No.)			Pasture loss (ha)	Value of loss (\$/farm)
		i	s	d		
Barley grass (<i>Hordeum</i> sp.)	NE Otago	12	7	3	4.6	698
	C. Southland	8	6	4	0.2	72
Broad-leaved dock (<i>Rumex obtusifolius</i>)	NE Otago	1	3	0	0.1	24
	C. Southland	2	2	0	0.1	28
Californian thistle (<i>Cirsium arvense</i>)	NE Otago	2	10	1	0.8	180
	C. Southland	8	10	8	9.6	3101
Cutty grass (<i>Carex geminata</i>)	NE Otago	1	0	0	0.1	24
	C. Southland	7	6	6	1.6	586
Gorse (<i>Ulex europaeus</i>)	NE Otago	7	5	10	5.9	851
	C. Southland	3	5	13	1.1	377
Nodding thistle (<i>Carduus acanthoides</i>)	NE Otago	4	17	3	5.3	800
	C. Southland	1	0	4	0.1	8
Scotch thistle (<i>Cirsium vulgare</i>)	NE Otago	0	3	0	0	0
	C. Southland	3	14	4	0.4	117
Grass grub (<i>Costelytra zealandica</i>)	NE Otago	1	9	4	1.3	256
	C. Southland	9	7	7	1.9	785
Grass grub & porina combined	NE Otago	0	4	2	1.8	84
	C. Southland	0	3	2	0.2	58
Stem weevil (<i>Listronotus bonariensis</i>)	NE Otago	0	3	0	0.7	224
	C. Southland	0	0	0	0.0	0

⁺ Status i = increasing in area, s = static, and d = decreasing

No. = number of farmers of the 52 sampled within each status classification

North-east Otago farmers renewed 10.6 ha/year of pasture which had been damaged by weed or insect pests, significantly higher than the 1.6 ha/year (SED = 3.5) renewed in central Southland. Farmers spent 15 days (SEM = 0.6) per year on weed and pest problems, with no differences between locations. The amount of money invested in equipment for the control of weeds and insect pests was \$1885 for north-east Otago, lower than the \$3642 (SED = 892) for central Southland.

Perceptions of weed and pest importance

Barley grass (*Hordeum* sp.), gorse (*Ulex europaeus*) and nodding thistle (*Carduus acanthoides*) were perceived to contribute the most to pasture or crop loss in the north-east Otago district, accounting for 15.8 ha or \$2349 per farm (Table 1). Californian thistle (*Cirsium arvense*) was considered to be the major weed in central Southland, accounting for a loss of 9.6 ha or \$3100 for 1991 per farm. Gorse (*Ulex europaeus*), cutty grass (*Carex geminata*) and Scotch thistle (*Cirsium vulgare*) together were estimated to contribute to a loss of 3.1 ha or \$1080 per farm. Most farmers in north-east Otago thought that barley grass was becoming more of a problem, and this weed together with gorse and nodding thistle would be their worst weed problem during the next 5 years. Farmers in both districts thought that gorse was decreasing in importance, and they considered the status of other weeds to be static.

Grass grub (*Costelytra zealandica*) was regarded by 33 farmers to be the most important insect pest in both districts, causing 1.3-1.9 ha pasture loss. Loss due to porina (*Wiseana* sp.) from six of the 11 farmers who had the problem was perceived to be minor, the other five farmers were unable to differentiate between porina and grass grub damage. In north-east Otago, a loss of 0.7 ha per farm was attributed to Argentine stem weevil (*Listronotus bonariensis*). Nine of the 23 farmers in the central Southland area who identified grass grub as a problem thought that the pest was increasing in importance, but in north-east Otago, all but one of 14 farmers considered grass grub to be static or of decreasing importance. Only one farmer considered Argentine stem weevil to be the most serious pest. Non-insect invertebrate pests were not mentioned in any reply.

From a list of six categories for expenditure most farmers (46) considered animal health to be their first priority, with weed and invertebrate pest control ranging from second (14), third, (17), fourth (16), fifth (4) to sixth (1) priority. Once expenditure for animal health had been satisfied, 23 farmers allocated surplus funds to fertiliser, 15 to debt reduction, six to weed and insect pests, five to capital purchases and three to personal as their next priority.

Knowledge and sources of information

Gorse, Californian thistle, nodding thistle and grass grub, were used as reference species to gauge farmer's knowledge of available control options, their information sources, and their weed and insect control practices (Stuck and van Toor 1992).

For chemical control, 88% of farmers sprayed herbicides to control gorse, and 59-67% of farmers sprayed to control other weeds. Information on herbicide choice was obtained from other farmers (46-59%), magazine articles (15-25%), chemical company representatives (6-28%), stock firm retail outlets (15-27%) and agricultural contractors (0-13%). Information on chemical wiping (a recent innovation) of Californian thistle was obtained from farming magazines, field days and A & P Shows. Half of the 41 farmers who cited grass grub as a problem said they were aware of spraying insecticide as a method to control grass grub. Fewer farmers mentioned broadcasting granule formulations, the more effective method of insecticide application. About a quarter of the 41 farmers actually applied insecticides. That farmers were such an important source of information on chemical control is in contrast with findings from a survey of Canterbury cropping farmers, where stock and station agents were considered the most useful source of advice for dealing with plant health problems, followed by newspapers and journals (Mohamed 1987).

For cultural controls, the main sources of information were other farmers. Cutting, grubbing (usually by bulldozer), burning and goats were the most well known and practised non-chemical options for control of gorse, but they were practised by less

than half of the farmers who were aware of them. Cutting was the most well known and practised non-chemical control option for Californian thistle, followed by hard grazing. Cutting and hand grubbing were favoured for nodding thistle control. Cultivation for grass grub control was known by 10 farmers and practised by eight of them. Sixteen farmers knew that heavy rolling can give economical control of grass grub under favourable conditions, but the technique was practised by only one farmer. Almost half of the farmers used trampling with sheep for control of grass grub. Autumn application of nitrogen, an effective technique in alleviating grass grub damage (van Toor *et al.* 1989) was not mentioned.

Less than half of farmers were aware of biological control options. Just over a quarter of farmers with gorse were aware from farming magazines or the county weed officer of relevant biological control agents. Only one farmer had paid to have the gorse spider mite (*Tetranychus lintearius*) introduced onto his farm, although nine farmers were well informed or knew a reasonable amount about the gorse mite, with 12 knowing a little. Less than half of the farmers with nodding thistle knew that biological control agents were an option, with four of the 13 farmers paying to have the seed head weevil (*Rhinocyllus conicus*) introduced onto their farms. Knowledge of the weevil was obtained from other farmers, farming magazines, the county weed officer, newspapers and radio. Ten farmers had heard about biological control of grass grub mainly through chemical companies, but this had not been adopted by any farmer. However, when asked "what do you know about the biological agent 'Invade' for controlling grass grub?", two farmers were well informed, 11 knew a reasonable amount, four a little, and 35 nothing. It is surprising that so few farmers knew about 'Invade', given the importance of grass grub and the publicity this product has received. This suggests that information on biological control needs to be promulgated more effectively.

Decision making

When asked how decisions to control weeds were made, the most common parameters used were (in order of number of responses) density, do it anyway, the size of area infested, rate of spread, effect on stock, and making the farm look untidy. The priority factor was the potential of the weed to spread. For insect pests, decisions were based upon visible damage, pest density and area affected.

Decisions on which control methods to use for both weeds and pests included (with number of responses in brackets): cost (32), weed density (20), the only plausible option (20), weed growth stage (18), and cost effectiveness (16), with less than nine responses for time involved, access and location, area affected, pest damage severity, paddock age, convenience, and past experience.

Reasons for control methods aware of but not used were pesticide application too expensive (36) or uneconomic (10), not effective (27), herbicides not selective enough (15), a philosophy against the use of pesticides (12), the area of infestation too small to warrant control (12), biological control agents unavailable (8) or not effective (5). Cultural methods were either too labour intensive (9), or had detrimental effects on stock (9). The inconvenience of keeping animals such as goats for weed control (6), and lack of time (6) were other factors.

If income improved (i.e. lambs fetched \$50 each), 43 farmers said that their present weed and invertebrate pest programme would change. North-east Otago farmers estimated that their revised weed and insect pest control programmes would cost \$8233, higher than the \$4023 (SED = 2122) estimated by central Southland farmers. These figures are 4.9 and 2.4 times greater than the amount actually spent on weed and pest control for north-east Otago and central Southland, respectively. Lack of funds was cited by the majority (34) of these farmers as being one of the reasons for the difference between existing and desired control. Less popular reasons included other priorities (10), and poor return on investment (8).

An extra \$3000 available specifically for weed and pest control would be spent by north-east Otago farmers on herbicide control of gorse (14), nodding thistle (5) and barley grass (5). Farmers in central Southland said they would spend the extra amount

using a carpet roller weed wiper for Californian thistle control (8), and spraying gorse (8), all thistles (6), cutty grass (3), daisies (*Bellis perennis*) (2) and barley grass (2). Two farmers would use the money for 'Invade' or chemical control of grass grub. One farmer from each location said they would do nothing. Farmers implied that their revised programme would in most cases just be an extension of their original programme. The exceptions were chemical control of Californian thistle with a carpet roller and use of 'Invade' to control grass grub.

Thirty farmers said they would use the extra pasture production or quality obtained from weed and insect pest control to increase stock numbers, 13 would increase stock performance but keep stock numbers the same, eight said they would do both, and eight said they would lease grazing.

Preferences for technology transfer

All farmers were interested in finding out about new or existing options for weed and pest control. Research most useful in the next 5 years included for weeds, biological control (28) and herbicides (18). Requirements for control options were that they should be of low cost (17), more effective (12), with permanent effects (11) and selective (8). For insect pests, biological control (17) and low cost options (12) were favoured. Research into management techniques, which tend to be low cost, was mentioned by only two farmers.

Sources of information included articles in farming magazines (37) and farming page of newspapers (12), field days (18), stock firms (10), and mailed fact sheets (5). Chemical companies (5) were favoured for information on chemicals, while MAF (4) was favoured for information on biological control. Farmers preferred information on weed and insect pest control to be presented in concise fact sheets in farmer language as a hand-out (27). Articles should include treatment comparisons from experimental or paddock-sized plots (16), illustrated with photographs (9), and be practical (5). Sixteen farmers favoured being present at field days to visually inspect treatment comparisons in experimental or paddock-sized plots. Thirty six of the 52 farmers said the 'key' method (Barratt *et al.* 1990) would be useful. It appears that this method of determining the best control option by following a path based on criteria relevant to the farmer's position, would be appreciated by farmers.

Most farmers found MAF/DSIR to be the most credible (37) and most useful (27) source of research information, as they were seen to be independent, having no financial interest in the concepts or products they were promoting. Ten farmers had no preference. Thirty one farmers said farm size trials were the most credible and 36 said they were most useful, while 15 said farm-based plot-size trials were most credible and 13 said they were the most useful.

Farmers obtained most of their information from other farmers, apparently because it was available information eagerly shared, and relevant in that it had usually been tried on neighbouring farms. The approach of holding well-advertised field days on large-scale field trials conforms to the preferences of farmers in this survey. Farmers who are involved in the design and running of trials share information related to their own experience. Fact sheets and bulletins highlighting treatment effects, with photographs, should be handed out at field days, or sent to participants later, with follow-up articles published in local newspapers. "Focus farms" and "monitor farms" have also been used by agricultural consultants to highlight and quantify farm performance by way of group discussions with farmers, and identifying needs for improvement. This approach also enhances sharing of information between farmers, under the leadership of farm consultants who impart new technologies. Information can also be transferred effectively to the farmer through tertiary education, as 10% of farmers had an agricultural degree or diploma. As long as tertiary institutions keep abreast of research findings, farmer-graduates would transfer much of the information to other farmers. Targeting information to stock and station agents, chemical representatives and members of farm discussion groups would be another effective method of exploiting the transfer of information from farmer to farmer. These recommendations agree with those of Gibbs (1970), who went further to say that extension

personnel should create dissatisfaction with present practices or productive levels through the demonstration of new or improved farming techniques.

CONCLUSIONS

Farmers estimated that they are currently spending just over half the amount of money needed to adequately control weeds and invertebrate pests. Cost of control was the most common criteria for deciding whether control was warranted. The most serious problems were gorse, nodding thistle, and barley grass in north-east Otago, and Californian thistles, cutty grass and grass grub in central Southland. Farmers were reluctant to apply pesticides. In their opinion, future research should concentrate on biological control options. Research institutions seen to be independent from the sales of agricultural products were given most credence. For farmers to accept new technology, it must be presented in fact-sheet hand-outs at field days on farm-sized trials within various regions. It must also be well covered at farm discussion groups by consultants and extension specialists, and in farm magazines as short concise articles.

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