WEED MANAGEMENT STUDIES IN LEY LEGUMES FOR CENTRAL QUEENSLAND FARMING SYSTEMS

V.A. Osten
Queensland Department of Primary Industries, LMB 6, Emerald, Queensland 4720, Australia

Summary The tolerance of six ley legumes (lablab, desmanthus, vigna, butterfly pea, siratro and lucerne) to the herbicides imazethapyr and imazameth applied at 96 and 48 g ha^{-1} respectively, were measured in two field experiments under central Queensland conditions. Treatments between the two trials differed with respect to herbicide application timing and legume species studied. Application timings across the two trials consisted of pre-planting (two weeks prior) and three and six weeks post-emergence. Visual weed control assessments were also undertaken. Legume biomass was measured four weeks after herbicide application, and total plant dry matter yields were measured four months after planting.

The pre-planting applications of both herbicides provided the best levels of grass and broadleaved weed control across all legumes. All legumes tolerated both herbicides particularly when applied post-emergence. Where early injury whether significant or not was detected, the majority of legumes were able to overcome any suppression without significant loss to final yield. Most early injury effects were manifested in the pre-planting (pre-emergence applications) treatments. Herbicide applications at six weeks post-emergence appear to be a waste. By this time the majority of legumes had developed good cover and were fairly competitive. At the same time, weeds which had emerged with the legumes were quite large and therefore tolerant of this late application of herbicides. These results are from one year's trial work only and will be validated over the next two years.

INTRODUCTION

The inclusion of a ley legume phase in the cropping systems of central Queensland is a relatively new practice and one which has not been widely adopted. Lack of information on weed management has been identified as a potential limitation to the development and adoption of the system. Effective weed control during the establishment and early growth phase of the ley pasture appears critical to the success of incorporating legumes into the farming system. Knowledge and development of effective weed control strategies are lacking, and little information exists on effective and safe methods of terminating the pasture phase to ensure that the legumes do not become a problem in the subsequent cropping phases. The benefits to the overall farming system in terms of weed management contributed by the ley phase are also unknown for this environment.

This paper reports the preliminary (first year) results of weed control and legume tolerance to two herbicides tested under field conditions in Emerald, Queensland during the 1995/1996 summer. Aspects of the work covering the termination of the ley phase, and the contribution the ley phase makes to weed management in the overall farming system will not be covered in this paper.

MATERIALS AND METHODS

Two completely randomized block trials each with three replications were located on the Emerald Research Station on a heavy black earth soil type. The first trial was designed to examine the tolerance of six ley legumes to applications of imazethapyr at 96 g ha^{-1} and imazameth at 48 g ha^{-1} applied three weeks after emergence. The second trial examined the tolerance of three of the ley legumes to the same herbicides (and rates of application) applied two weeks pre-planting and at three and six weeks post-emergence. Weed control efficacy was also recorded for this latter trial. All herbicide treatments were applied with a boom mounted on an all terrain vehicle delivering 62 L ha^{-1} volume output. Wetting agent was not added to the post-emergence treatments. All plots were split for weeded and unweeded (where weeded subplots were hand weeded just prior to the first post-emergence application). Legume biomass samples were taken four weeks after herbicide application except in the pre-emergence treatments where the first sampling coincided with that of the first post-emergence treatments. Dry matter production was determined from these samples. All plots were forage harvested in late February 1996 for dry matter yield (per hectare). The weed control measurements consisted of a visual assessment using a rating system.

The legumes of the first trial consisted of lablab (*Lablab purpureus* (L.) Sweet cv. Hyworth), siratro (*Macroptilium atropurpureum* (DC.) Urban cv. Aztec), desmanthus (*Desmanthus virgatus* cv. Marc), butterfly pea (*Clitoria ternatea* L. cv. Milgarra), vigna (*Vigna trilobata*) and lucerne (*Medicago sativa* L. cv. Trifecta). Only desmanthus, lablab and siratro were examined in the second trial. All legumes were planted in early November at commercially recommended sowing rates, and three consecutive days of light irrigation (10 mm day^{-1})

was applied to ensure emergence and establishment. The majority were surface sown with a seven row planter (25 cm row spacing) fitted with press wheels, except the lablab which was sown on 60 cm rows at a depth of 5 cm.

All legume data collected were subjected to analysis of variance with least significant differences (LSD) used to test between means only when the *F*-value was significant ($P<0.05$). Individual legumes were analysed separately. The six week post-emergence treatments were also analysed separately to the pre- and three post-emergence treatments.

RESULTS AND DISCUSSION

Weed control Both imazethapyr and imazameth produced excellent (>95 %) pre-emergence control of the summer grass weeds: *Brachiaria eruciformis* (Sm.) Griseb. (sweet summer grass), *Echinochloa colona* (L.) Link (awnless barnyard grass), *Urochloa panicoides* Beauv. (liverseed grass), and the summer broadleaved weeds: *Tribulus terrestris* L. (caltrop), *Trianthema portulacastrum* L. (black pigweed), *Amaranthus mitchellii* Benth. (Boggabri weed), *Hibiscus trionum* L. (bladder ketmia), *Corchorus trilocularis* L. (native jute), *Abelmoschus ficulneus* (L.) Wight & Arn. (native rosella) and *Euphorbia vachellii* L. (a spurge). Neither herbicide affected *Sesbania cannabina* (Retz.) Poir. (sesbania pea) or *Vigna* sp. (a native mung bean) either pre- or post-emergent.

Table 1. The effects of imazethapyr (A) and imazameth (B) on early growth – DM[A] and final yield – DM in *Lablab purpureus*.

Herbicide and timing[B]	Early DM ($g\ 0.06m^{2\ -1}$)	DM yield ($t\ ha^{-1}$)
Nil weeded	59.0	4.3
Nil unweeded	42.7	
A pre- weed	51.7	6.7
A pre- unweed	40.6	
A 3W weed	46.1	7.2
A 3W unweed	36.0	
B pre- weed	41.7	6.5
B pre- unweed	43.4	
B 3W weed	47.2	5.1
B 3W unweed	48.6	
LSD (P=0.05)	not significant	
Nil weed	100.1	as above
Nil unweed	79.1	
A 6W weed	93.7	5.9
A 6W unweed	94.8	
B 6W weed	101.8	4.8
B 6W unweed	82.7	
LSD (P=0.05)	not significant	not significant

[A] DM = dry matter.

[B] pre- = pre-emergence; 3W or 6W = 3 or 6 weeks post-emergence; weed/unweed = weeded or unweeded.

Neither herbicide provided good levels of weed control for either post-emergence application timing. The six week post-emergence application produced no effects in any weed. The three week post-emergence application of both herbicides did however produce good levels of suppression in most of the broadleaved weeds mentioned above. Only the imazameth suppressed the grass weeds. Across the spectrum of weeds, imazameth performed slightly better than imazethapyr when applied post-emergence.

While the three week post-emergence application of both herbicides did not control the weeds, the levels of suppression produced were sufficient to allow the legumes to adequately compete. At the time of spraying, the majority of weeds were actively growing but becoming quite large (>6 true leaves), too large to assume effective control. The six week application was a waste, with the weeds very large. By this time the majority of the legumes had developed extensive canopy covers and were competing very well. Ideally, the pre-emergence applications are the most desirable as they ensure the legume has the competitive advantage right from emergence. Future trial work will need to cover earlier (that is <3 weeks) post-emergence application timings. It would appear that applications at three weeks post-emergence are sufficient when the growing season is good, however, these results may have differed had the season turned dry and the legumes produced less growth and therefore been less competitive.

Legume tolerance Generally all legumes appeared and measured tolerant (that is, no significant early biomass or yield reductions) to both herbicides for both post-emergence application times. The pre-emergence application of both herbicides was only tested on three of the six legumes. All three legumes tolerated both herbicides. Where early growth effects, whether significant or not, were recorded, the legumes were able to compensate in later growth such that yield were unaffected. Generally, the unweeded subplot for each treatment showed a reduced early growth compared to their weeded counterpart. This would indicate that the effects of weed competition were contributing more to early biomass reductions than the effects of the herbicides themselves. The data produced across all legumes are too numerous to show in their entirety, however, as an example, the information for the tolerance of *Lablab purpureus* to both herbicides is presented in Table 1.

The data trends in Table 1 were similar for the desmanthus and the siratro. The pre-emergence and six week post-emergence treatments were not applied to the lucerne, butterfly pea or vigna, however the data trend for the three week post-emergence application in the lablab (Table 1) was also similar for these other legumes except for the lucerne. The effects in lucerne have been attributed to the inappropriate variety/cultivar. As yet no variety has been bred that suits the central Queensland climate. Existing varieties, including cultivar Trifecta do not establish or perform well in this region, and are consequently easily out competed by weeds.

ACKNOWLEDGMENTS

This research is funded by the Grains Research and Development Corporation and the Queensland Department of Primary Industries. I am grateful to Kevin McCosker, Glen Millar, Simone Chapman, David Osten, Karen Rutherfurd and John Ladewig for providing valuable technical assistance.