WEED CONTROL IN PERENNIAL PASTURES:

TOLERANCE OF PERENNIAL PASTURES TO HERBICIDES

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Abstract: *The success of selective herbicides in perennial pasture production depends on the tolerance or resistance of pasture plants to the effects of herbicides. Pasture damage can occur, and this is often inconsistent because of plant, herbicide and environmental factors.The importance of tolerance is greatest in the establishing phase of pastures, where competition from weeds often threatens the survival of pastures. Damage is also discussed in relation to herbicide use in established pastures; sowing pastures into non-arable country, herbicide drift, herbicide residues and seed production.The maintenance of a vigorous growing perennial pasture and adequate planning of pasture development as well as efficient use of herbicides is emphasised as an important strategy to reduce damage caused to pastures by the use of herbicides. Where lack of tolerance is a problem, the damage caused by the herbicide has to be balanced against the advantages of weed control.*

Selective herbicides are a valuable tool used in pastures to effectively remove weeds from a group of desirable plants- the pasture. The weed has low tolerance or is susceptible to the herbicide, whereas the pasture plants have good tolerance, or better still are resistant to the herbicide.

It is unusual to find the weed completely susceptible and the pasture completely resistant. For this reason, pastures may be damaged using selective herbicides. The level of damage is normally acceptable when the herbicide is used as directed.

The effect of herbicides on pasture plants can be inconsistent as many factors can influence the reaction of a plant to a herbicide. Those of practical significance are:

- **The Herbicide** - The formulation, additives, rate of application, efficiency of application (water volume, droplet size, coverage).
- **The Plant** -The inherent tolerance of the plant/variety, the stage of growth, overall health of the plant, and the grazing or cutting management both before and after application.
- **The Environmental Conditions** -Season, temperature, wind, humidity, rainfall, soil moisture, type, fertility and pH.

The importance of some of these factors is evident in the following examples of pasture operations where the lack of tolerance of perennial pastures to herbicides can cause concern.

CONTROLLING WEEDS IN SEEDLING PASTURES

Seedlings of perennial pastures are generally more sensitive to the effects of herbicides than later growth stages.

Bromoxynil and 2,4-DB are widely used, and although they are considered safe herbicides on establishing pastures some tolerance problems do occur.

Bromoxynil is useful for removing a wide range of young (less than 6 true leaves) broad- leaf weeds from pastures. The tolerance of pasture species is usually good but reduces with rising temperatures (above 18-20°C). Unacceptable losses occasionally occur in coastal areas, and hotter inland areas. Damage from winter application in the sheep/wheat belt is usually not noticeable; however late sowing and subsequent late herbicide application (late winter/spring) may be accompanied by leaf damage.

2,4-DB if used as recommended for broad leaf weed control in lucerne, white and red clover based pastures is considered safe but can cause damage, especially to lucerne. Producers should be aware that not all legumes are tolerant to 2,4-DB, especially when new species are being sown. A recent screening trial on seedlings found that lines of lotus, round leaf cassia, desmanthus, creeping vigna, axillaris and lotononis were susceptible to 2,4-DB (Loch and Harvey, 1990).

The selectivity of 2,4-DB depends on it being converted to 2,4-D by susceptible plants but not by resistant plants. Stem distortion and scorching are seen frequently on legumes as well as a moderate reduction in dry matter yield. Less damage tends to occur between the 1st and 8th trifoliate leaf stage. Plants become more susceptible after this stage.

Plants of tolerant species such as lucerne, red and white clover usually recover from damage although sometimes slowly. The setback to growth in the short term may be unsightly and unacceptable, and recovery can be very slow.

The same herbicides are used with few problems on perennial grasses (Watson and Strachan, 1987), although young perennial grass seedlings, less than the 5 leaf stage, can be damaged by hormone herbicides at moderate rates and some species are more susceptible, *eg.* Mitchell grass.

The selection of species for sowing may also be affected because of the need to use a particular herbicide to control weeds during the establishment phase. Grasses are often left out of pasture mixtures because they will not tolerate the pre-emergent herbicide trifluralin. Similarly, legumes are left out of mixtures sown into country infested with St. Barnaby's thistle, and are only included after the weeds are controlled. Good forward planning can overcome such problems.

HERBICIDE RESIDUES

The lack of tolerance of seedling perennial species to some of the herbicides used in aerial-spray-sow and direct drill work is well known. As a result, advisable plant back periods have been determined to enable pastures to establish uninhibited by herbicide residues. Whilst some of these periods appear lengthy (*eg.* 21 days) , they are necessary to cover the range of variables that can reduce the activity of herbicides. The sulphonyl urea group of herbicides such as Glean$^{(R)}$, are now used widely on cereals. Producers should be aware when sowing lucerne that its tolerance to these herbicide residues is low. The residues of Glean$^{(R)}$ in particular may adversely affect the emergence of lucerne (and medic and sub clover) for up to 22 months following application.

When deciding to use sulphonyl urea herbicides such as Ally$^{(R)}$, Amber Post$^{(R)}$, Glean$^{(R)}$, Harmony M$^{(R)}$ or Logran$^{(R)}$ in crops, keep in mind your pasture program for the following season. Similarly, ensure that spray equipment is thoroughly decontaminated after use, as subsequent treatment of pastures may cause unacceptable damage. As a general rule check the likely residual problems of previously used herbicides before spraying pastures with the same equipment.

On a more positive note, work in northern NSW has shown summer growing grasses such as bambatsi panic, purple pigeon grass and curly Mitchell grass to be quite tolerant to high rates of Logran$^{(R)}$ applied presowing (McMillan and Cook, 1990).

Both lucerne and white clover have been reported to be intolerant of trifluralin if sowing occurs soon after application. The problem has been greatest when high rates are used, and/or applied to light textured soils, and/or applied late in the season when plant growth is slow. Under good conditions it is preferable to wait a week after herbicide application before sowing. Under cold wet conditions however adverse affects have been observed following a 3 week delay in sowing.

The herbicide Goal$^{(R)}$, an additive to Roundup CT$^{(R)}$ has been found to damage cocksfoot much more than phalaris or lucerne (M.H. Campbell, pers. comm.). This sensitivity should be taken into account when determining the period between spraying and sowing.

PLANNING REDUCES PROBLEMS

Good planning is essential to overcome problems of weed control in establishing pastures. A 2 year lead of sowing is not unrealistic, and indeed a couple of seasons is needed for effective control of some weeds that are likely to damage pastures.

Pastures must be treated as high value crops, and inspected throughout the establishment phase for likely weed problems. If herbicides are used at establishment, ensure spraying is done at the right growth stage, and that they are applied effectively.

CONTROLLING WEEDS IN ESTABLISHED PASTURES

Perennial species have the advantage of more extensive root systems and should handle stress such as herbicide application better than annuals. This is not always so. Herbicide damage can reduce the competitiveness of the pasture and allow invasion of weeds.

Two aspects need to be considered; (1) the general well-being of the plant and (2) the amount of green material exposed to absorb herbicide. Herbicide damage in established perennials can often be attributed to inattention to these two aspects.

Weakened perennial pasture plants can be highly susceptible to herbicide damage and competition from weeds. This is particularly the case with lucerne which requires a 5-6 week break between grazing or cutting. This period allows root energy reserves to build up, so that plants can recover quickly. It also allows the plant to better withstand competition and stress. This effect is best illustrated by the effect of early cutting of lucerne and the subsequent weakening of the plant allowing summer grass invasion and loss of lucerne plants (Lodge, 1986)

Whilst perennial grasses may not be as reliant as lucerne on a long spell between grazing, their ability to survive stress, such as an application of herbicide, is still important. The effects of overgrazing, drought and the lack of adequate nutrition may all weaken perennial species and make pastures more susceptible to weed invasion and damage from stress such as herbicide application.

VARIETAL DIFFERENCES

Highly winter-active lucerne varieties are more sensitive to 2,4- DB than semi- dormant varieties (Schrodter *et al.*, 1984). Screening work is currently conducted at the species level (as opposed to the variety level) and consequently different varieties could react differently to a herbicide.

HERBICIDE DRIFT

Damage to non-target perennial pastures, especially lucerne, occurs all too frequently. The most common problems occur with low-volume water-based herbicides, and volatile herbicides such as esters of 2,4-D and MCPA. However, damage has occurred from a large range of herbicides, and when used in all manner of situations.

Producers must be aware of the intolerance of some species to herbicides and know under what conditions drift is likely (see Weatherstone, 1991).

MANAGEMENT STRATEGIES

The use of cutting and grazing to reduce the leaf area exposed is a useful strategy and can substantially reduce the effects of herbicides (McMillan and Cook, 1990). Although this may have practical limitations in large paddocks, it is a strategy that has been useful especially for control of unpalatable weeds. The use of 2,4-D or MCPA on mixed pastures that may contain some lucerne is a case in point. Ungrazed lucerne plants can be totally destroyed whereas a hard grazed pasture, especially in winter may survive such an application. Cutting or grazing however does not guarantee safety.

The more dormant the pasture at spraying, the less damage usually results. This is especially the case with species that are frosted off *eg*. summer growing grasses. Lucerne however, can show greater damage in winter because of the slow growth rate and ability to outgrow herbicide effects.

Lack of tolerance to herbicides in established perennial pastures can be assisted by the "spray graze" technique, that is, the use of sub-lethal rates of herbicides (for the weed and pasture) combined with strategic grazing management. However, the health of the perennial is important, as it has to withstand the effects of herbicide and the heavy stocking.

Herbicide use in established pastures should not be looked at in isolation as the way to control weeds. Well established and well managed perennials provide a sound basis for long term weed control and stable pastures.

ESTABLISHING PASTURES INTO EXISTING PASTURES

With the exception of pasture renovation, herbicide use has largely aimed at killing existing pastures to eliminate or reduce competition until the new pastures are sufficiently developed to compete successfully.

With increasing awareness of the value of native pastures, the retention of some species in new perennial pastures could well be desirable. Recent work using Roundup$^{(R)}$ on the Southern Tablelands has shown *Microlaena* (meadow rice grass) to be tolerant and *Danthonia* (wallaby grass) sensitive (Simpson and Keys, 1990). As well, both species were found to be tolerant to simazine. This opens up possibilities for removing competitive species such as *Vulpia* (rats tail fescue or silver grass) from these valuable grasses and adding more useful species.

ADDITIVES

Herbicide additives (*eg*. crop oils and wetters) can increase the effectiveness of a herbicide but at the same time they often reduce the selectivity of the mixture and pasture damage increases. Label directions should be followed closely to avoid problems of this nature.

SEED PRODUCTION

The effects of herbicide damage on seed production are often overlooked by livestock producers. Adverse effects are less important to them with perennials than with annuals, however to seed producers, in-crop weed control is critical for good clean seed yields. A knowledge of efficient herbicide use, and a knowledge of the tolerance of their crop to herbicides is essential. Weed Control and Demonstration Units at Orange and Glen Innes assist by screening herbicides for perennial pasture seed production.

HERBICIDE DAMAGE AND ECONOMICS

The damage caused by the herbicide has to be balanced against the advantages gained. In seedling pasture, large benefits are gained as plant survival is at risk.

The practical and economic importance of intolerance to herbicides of our perennial species of course varies with the individual situation.

Substantial losses in dry matter can be accepted where the level of feed utilisation is not high. Losses up to 15-20% occur and would probably not be detectable in the field if leaf symptoms were not present. What has to be avoided in perennial pastures at all costs is permanent damage and plant loss.

In older pastures, the advantages are not as clear cut, and the likely returns from the expenditure need to be carefully assessed. For example, the use of Sprayseed$^{(R)}$/diuron to clean up lucerne pastures in the winter months may kill all lucerne top growth and look devastating, however the reduction in grass seed problems to the prime lamb enterprise in the spring, can be readily justified by many producers.

Fortunately, in established pastures there are alternative methods of weed control that may be more appropriate than using herbicides.

CURRENT WORK AND FURTHER INFORMATION

Work on herbicide tolerance currently being undertaken by NSW Agriculture & Fisheries covers phalaris, lucerne, white clover, kikuyu, bahia grass, *Digitaria* and *Danthonia*. Our colleagues in Victoria and South Australia are also screening herbicides on some perennial pastures.

A summary of known tolerances of pasture species to herbicides is published in "Weed Control in Lucerne and Pastures" available from NSW Agriculture & Fisheries. This publication is updated regularly and should be consulted if doubts exist as to possible damage from a herbicide. Additionally, chemical companies such as Nufarm publish charts covering tolerances of legumes to herbicides. As labels are updated, tolerance information is added. ***Label directions should be always be followed.***

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