rapidly followed by hot, drying conditions.

The most effective additive for 1.5 lb phenmedipham has proved to be 2,2-DPA at 2 lb, either formulated as the sodium salt or as a glycol diester. Field trials and farmer usage of the former additive has especially assisted in the control of seedling wireweed and also of seedling grasses. Advanced weeds up to the four leaf stage and fathen up to the eight leaf stage are more effectively suppressed with the phenmedipham-2,2-DPA mixture. No worthwhile improvement in control of red root has been achieved with any beet-selective additive to phenmedipham. A combination formulation of phenmedipham and 2,2-DPA ester has been prepared which is now under advanced field testing. Beet selectivity at the double dosage appears quite acceptable for phenmedipham treatment under normal temperature conditions.

No pre-emergence weed control of significant value has been achieved with mixtures of phenmedipham with soil-acting pyrazon or lenacil except when the soil is moist to the surface. The control of later-germinating annual broadleaf weeds in beets remains a problem nearly as important as that of tolerant weed species. A second application of phenmedipham is now commonly required in field practice to control the second strike of weeds. A soil-incorporated, vapour-acting type of herbicide such as cycloate may be of value for residual weed control if it is followed by phenmedipham for the control of late-germinating weeds, especially in the more sensitive red beet crop.

WEED CONTROL IN LETTUCE

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Weed control in lettuce is important because the crop competes poorly with weeds which are also hosts to pests and diseases (Aphidiodes, Septoria) which can further reduce crop yield and quality.

The growth habit of the lettuce (rosette type) and the brittleness of its leaves make it susceptible to mechanical damage. Mechanical weed control does not give satisfactory in-row control.

Chemical weed control is made difficult as indicated by the use of lettuce as an indicator plant in soil in bio-assays.

PRELIMINARY TRIALS

Preliminary trials 1967/68 at Hawkesbury Agricultural College screened the following chemicals:

In July 1967 chloramben, 2, 4 lb/ac. (2.24, 4.48 kg/ha) CDEC 5 lb/ac (5.60 kg/ha), DCPA, 12 lb/ac (13.45 kg/ha), monuron, ½, 1 lb/ac (0.56, 1.12 kg/ha) siduron, 2 lb/ac (2.24 kg/ha) CP50144, ¼, ½ lb/ac (0.28, 0.56 kg/ha), propachlor, 2, 4 lb/ac (2.24, 4.48 kg/ha) trifluralin, ½,1 lb/ac (0.56, 1.12 kg/ha).

In October 1967; combinations of,

benefin, 3/4, 1½ lb/ac (0.84, 1.68 kg/ha) (chloramben,1,2,3,lb/ac)X(1.12,2.24,3.36 kg/ha
CP 50144,4,6 oz/ac (0.28,0.42 kg/ha) (monuron ½,3/4,1 lb/ac (0.56,0.84,1.12 kg/ha

In August, 1968; chloramben, 1, 1½, 2½ lb/ac (1.12, 1.68, 2.80 kg/ha) monuron, 3/4 1 lb/ac (0.84, 1.12 kg/ha) benefin, 1, 1½ lb/ac (1.12, 1.68 kg/ha).

In September 1968; benefin, 1, 1½ lb/ac (1.12, 1.68 kg/ha) with monuron, 3/4, 1 lb/ac (0.84, 1.12 kg/ha) dichlobenil, 3, 4 lb/ac (3.36, 4.48 kg/ha) and siduron, 1, 2 lb/ac (1.12, 2.24 kg/ha).

Of these, DCPA, CDEC, trifluralin, siduron, propachlor, CP 50144, monuron and dichlobenil caused serious damage to established lettuce plants and seedlings or because of unfavourable effects on germination and establishment and were discarded.

Chloramben and benefin showed promise, chloramben as a broad-leaf killer and benefin as a grass killer. Combinations of both gave good broad leaf and grass control.

Seasonal pattern of weeds at Hawkesbury Agricultural College *Poa. annua, Galinsoga parviflora, Cotula australis, Stellaria media* were present in autumn and winter. *Stachys arvensis* was present in autumn. *Spergula arvensis, Capsella bursa-pastoris, Rumex acetosella* and *Digitaria sanguinalis* occurred in winter trials. *Eleusine indica* and *Echinochloa crus-galli* occurred in spring trials. The main broad-leaf weed, *Nicandra physaloides,* occurred in all seasons, with the heaviest infestations in spring and summer.

Control of either grasses or broad leaves allows the surviving group to completely dominate. This results in a weed population which may reduce crop yield more than no control.

AUTUMN 1969 TRIAL

In April 1969 a trial in direct-seeded lettuce used, various combinations of benefin, carbetamide and chloramben were compared with each alone. Treatments were replicated (3 times), the plot size being 12' x 18". (3.66 mx 0.46 m = 1.68 m^2).

Treatment used were:
benefin, 1 lb/ac (1.12 kg/ha) incorporated with chloramben, 1, 2 lb/ac pre-em (1.12, 2.24 kg/ha).
carbetamide, 1, 2 lb/ac (1.12, 2.24 kg/ha) pre-em, with chloramben 1, 2 lb/ac (1.12, 2.24 kg/ha) pre-em.
benefin, 1 lb/ac (1.12, 2.24 kg/ha) incorporated.
carbetamide 1, 2, 4 lb/ac (1.12, 2.24, 4.48 kg/ha) pre-em.
handweeded control
not treated control.

RESULTS

The variates wet weight of lettuce, numbers of *Nicandra physaloides* as a most frequent broad-leaf and total numbers of broad-leaf and grasses have been analyzed. The combination of carbetamide 2 lb/ac (2.24 kg/ha) with chloramben 1 lb/ac (1.12 kg/ha) gave good grass and broad-leaf control without effect on the lettuce. The combination of benefin 1 lb/ac (1.12 kg/ha and chloramben 1 lb/ac (1.12 kg/ha) gave good grass control and was non-toxic to lettuce. Broadleaf control with benefin/chloramben was significantly worse, *Nicandra physaloides* showing resistance.

The combination of benefin 1 lb/ac (1.12 kg/ha) and chloramben 2 lb/ac (2.24 kg/ha) provided satisfactory control of grasses but not of broadleaves, especially *N. physaloides*. This treatment also lowered crop yield.

The carbetamide 1 lb/ac (1.12 kg/ha) and chloramben 2 lb/ac (2.24 kg/ha) combination gave excellent broadleaf control and unsatisfactory grass control. This combination also lowered crop yield.

Chloramben at 1, 1½, 2 lb/ac (1.12, 1.68, 2.24 kg/ha) did not control weeds, but depressed crop yields. Benefin 1 lb/ac (1.12 kg/ha) alone gave good grass control but no control of broadleaves which lowered the yield. The carbetamide alone at 4 lb/ac (4.48 kg/ha) rate gave a very good grass and broadleaf control. Crop yield was significantly depressed.

Carbetamide at 4 lb/ac (4.48 kg/ha) was the only herbicide tested to give satisfactory control of weeds in a lettuce crop. However, it lowered crop yield. Responses to other herbicides applied alone gave either good grass or broadleaf kill. Chloramben alone did not give satisfactory control of either broadleaves or grasses.

The best results were obtained with the combination of carbetamide with chloramben and benefin with chloramben.

Further experiments would confirm these results and indicate the best combinations of benefin, carbetamide, and chloramben.

THE BARLEY GRASS PROBLEM IN THE MANIOTOTO DISTRICT

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The semi-arid Maniototo Plains lie at an altitude of 1,200-1,400 ft within the Otago Central Climatic District (Garnier, 1950), which is characterized by low rainfall, cold winters, and hot summers. Mean annual rainfall varies from 15 to 17 in. of which 12-14 in. falls between September and April. Nevertheless, because of high annual evaporation there is a large deficit of soil moisture during the growing season and production is particularly vulnerable to prolonged drought.

The soils are brown-grey earths mainly derived from schist or greywacke alluvium.

The farming is largely semi-extensive sheep grazing with nearly 30% of the area sown to lucern; this may increase as climate, soils, and farming pattern are all conducive to its use.

Lucerne is normally sown in 7 in. drills and it may take 2 years to establish satisfactorily. Its growth is characterized by an extreme peak of production in October-November; this is conserved as hay and the stand is grazed more or less extensively for the remainder of the year. A stand may produce hay for 10 years, but can be grazed for up to 40 years. The carrying capacity is about 1.0-1.5 ewe equivalents per acre.

The combination of climate and management renders lucerne extremely susceptible to invasion by annual weeds, particularly barley grass. The species involved is principally *Hordeum marinum*, although it is now suspected that much *H. glaucum* is present (Allen, pers. comm.). On marginal salt areas *H. hystrix* is common with *H. marinum* apparently more salt tolerant, while *H. jubatum* occurs occasionally in damp, marginally salty areas.

Infestations are confined almost entirely to the lucerne areas. Encouraged by the management system, barley grass germinates easily in the interdrill spaces after late summer-autumn showers while constant grazing reduces lucerne