non-residual desiccants, such as power kerosene or a quaternary ammonium compound, and blanket spray the full trial area soon after the emergence of any weeds.

This method is applicable to pre-emergent work, but the application of post-emergence chemicals to bare ground is unusual. Weed growth cannot be allowed because the control plot may have a mixture of perennial grasses and broad-leaf weeds and, after continued applications of 2,2-DPA (2,2-dichloropropionic acid), the grasses are removed, while with arsenic trioxide the broad-leaf weeds are removed, and we have our crop growing in three distinct floras. Therefore we must revert to the standard of bare ground. Under these conditions for post-emergent herbicides the amount reaching the ground is greater than when applied to the weed foliage. We have reaching the soil, however, the maximum possible amount, which may be equivalent to a heavy storm soon after application of the herbicide to a normal weed stand. As this gives us the upper limit of crop phytotoxicity for the given rate of herbicide, it is possibly what we require in a phytotoxicity trial.

2. The second point that arises is that a single chemical recommendation for weed control in standing crops will fail. Weed control should be based on a program indicating the possible changes in weed flora and the steps to be taken to rectify the situation. A typical program for bananas established on virgin country would be to eliminate native grass species and control broad-leaf weed growth with a 2,2-DPA/amitrole mixture. On the elimination of these grasses, arsenic trioxide will be very effective until certain resistant broad-leaf weeds and annual grasses build up at which time a swing to paraquat (1,1′-dimethyl-4,4′-bipyridylium cation) would be warranted. Should perennial grasses begin to appear at this stage, a repeat of the cycle would be indicated. If there is no encroachment of perennial grasses an alternate spray of arsenic trioxide will tend to prevent the development of a flora resistant to one herbicide.

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CONTROLLING WEEDS IN CANNING PEAS WITH SELECTIVE HERBICIDES

Green peas for canning or freezing occupy a current acreage of 15,000 (av. yield 2,500 lb), and are an important item in Tasmanian agriculture. The crop is grown principally on a free-draining basaltic krasnozem soil which allows early sowing. Other soils are used, but to a lesser extent, and usually for late sowings. With sowing spread from June to December, a wide range of weed species can be expected.

Weeds are mostly annual dicotyledonous species, usually in complex associations. They include cruciferae (Raphanus raphanistrum, Brassica spp., Capsella bursa-pastoris, Sisymbria, etc.), Stellaria media, Calandrinia ciliata, Fumaria officinalis, Spergula arvensis, Polygonum convolvulus, Lamium amplexicaule, Polygonum aviculare, and, in late crops, Chenopodium album and Solanum nigrum. Rumex species occur in some areas. Weed control is often a critical factor in the production of canning peas. Trials carried out in 1955 and 1957 showed that a moderate infestation of wild turnip and wild radish can reduce yields by one-third. Heavy infestations of almost any weeds can cause complete crop failure.

The following is a summary of results of two replicated field trials carried out with post-emergence herbicides in 1957 (Kennedy). Yields of peas considered in each case as a percentage of the control (100%) were: MCPA (2-methyl-4-chlorophenoxyacetic acid) (5 oz per acre) 135%, 136%; DNBP (4,6-dinitro-o-sec-butyl phenol) amine (15 oz) 149%, 164%; DNBP + MCPA (2½ oz) 159%, 156%; MCPB (4-(2-methyl-4-chlorophenoxy)butyric acid) (22 oz) 116%, 147%. Confirmatory results were obtained using small-plot trials (L. Smith) in 1958.

Because the peas are drilled in at 6 in. or 7 in. spacing, interrow cultivation is impossible and, as sowing dates are predetermined and must be adhered to, fallowing and other cultivation for weed control is of limited value.

Commercial spraying with MCPA at rates between 3 oz and 5 oz a.e. per acre was first employed in 1951 and proved of economic value when the weed flora were restricted to susceptible cruciferous weeds, fat hen, and seedling docks. Even at low rates, peas are checked severely and the theoretical yield of a weed-free crop reduced by 10% or 20%.

Ammonium DNBP, first employed in 1954, widened considerably the range of controllable weeds. Fumitory and black bindweed, both serious weeds in peas, are very susceptible to DNBP, which deals adequately with most other annuals. Spurry, chickweed, and calandrinia, commonly found in early crops, are moderately resistant unless weather conditions favour the action of the herbicide.

Application difficulties occur with ammonium DNBP, and a change to the amine salt was made in 1956. This gives satisfactory weed control when $(NH_4)_2SO_4$ is used as an activator; 4 oz $(NH_4)_2SO_4$ added to a solution of 16 oz DNBP (a.e.) in 15 to 20 gallons of water is the standard recommendation rate for average weather conditions. The use of activator sometimes causes scorch but yields are rarely affected.

MCPB was first employed in 1956, but under local conditions did not prove any more effective or safer than MCPA and is very little used.

Although an efficient herbicide, DNBP is highly poisonous and for safety reasons is more suitable for application by a contractor than the grower. In 1961 and 1962, triazines and other root-absorbed residual herbicides were investigated.

Replicated trials in 1961 (Blacklow) showed that propazine (2-chloro-4,6-bis(isopropylamino)-s-triazine) and diuron (N-(3,4-dichlorophenyl)-NN-dimethylurea) could be used before emergence on peas at up to 2 lb active ingredient, giving good weed control, especially of spurry. Monuron (N-(4-chlorophenyl)-NN-dimethylurea) damaged peas severely and prometryne (2-methylmercapto-4,6-bis (isopropylamino)-s-triazine) gave inadequate control of problem weeds. In a trial in 1962, propazine and diuron gave significant control of spurry but DNBP did not. No significant yield differences over the control were obtained with any herbicide in this trial. Propazine at 1½ to 2 lb active ingredient per acre was used commercially in 1963. It gave excellent results on krasnozem soils as long as soil conditions remained damp but, with the onset of dry conditions, failed to control weeds from mid-October onwards.

When used under suitable conditions, propazine will control many weeds in peas for up to 8 or 10 weeks without affecting theoretical yields. Survivors are usually perennials and annuals originating from seeds in the deeper layers of the soil. On soils other than basaltic krasnozems, instances of severe damage to peas have occurred after using propazine at rates as low as 1 lb per acre, and this matter is being currently investigated. The problem of increasing its effectiveness under dry soil conditions (possibly by mechanical mixing with the soil) is also receiving attention.

Percentages of sown areas sprayed with different herbicides in 1963 and 1964 were:

1963	(DNBP	22%	1964	(DNBP	19%
	(propazine	1%		(propazine	15%
	(MCPA and MCPB	3%		(MCPA and MCPB	2%

MCPA at 2-4 oz per acre is sometimes mixed with DNBP to assist control in certain weed associations.

The rapid increase in the use of propazine is striking, its popularity being due to its safety and the fact that crop traffic is avoided.

Conclusions - Three herbicides, each differing widely from the others in mode of action, find a place in pea cropping and are currently in use.

The use of MCPA and MCPB is likely to continue even if reduced because they are the only materials available to control docks and advanced cruciferous weeds. Unless replaced by newer herbicides, DNBP and propazine are likely to be used extensively and fairly equally in the future, one being complementary to the other. Propazine is most effective on early weeds under wet conditions, while DNBP is more active when conditions are warm and relatively dry.

Changes in the pattern of herbicide usage have been brought about not only by the introduction of improved chemicals, but also because of changes in weed flora due mainly to the use of phenoxyacetic herbicides on other crops grown on the same land.

While overseas information has been of assistance, the full potential of the various herbicides in use has been realized only by careful work on the part of those concerned with the industry: the pea-grower, the processor, the spraying contractor, and the departmental agronomist.

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CONTROL OF WEEDS IN PROCESSING PEAS

1. Introduction - Over the last 5 years the area of peas grown for freezing and canning in Western Australia has increased spectacularly, over 1,500 acres being grown in 1964. This is likely to increase still further in the near future. Much of the potentially suitable land is heavily infested with weeds including Cape-weed (Cryptostemma calendula), double gee (Emex australis), wild turnip (Brassica tournefortii), and annual grasses of which the most important is Wimmera ryegrass (Lolium rigidum). It is difficult to obtain effective control of these species by cultural means.

A number of trials have been conducted previously by the author (1963) using a wide range of chemicals including CDEC (2-chloroallyl-*NN*-diethyldithiocarbamate), amiben (3-amino-2,5-dichlorobenzoic acid), atratone (2-methoxy-4-ethylamino-6-isopropylamino-*s*-triazine), propazine (2-chloro-4,6-*bis*(isopropylamino)-*s*-triazine), prometryne (2-methylmercapto-4,6-*bis*(isopropylamino)-*s*-triazine), prometone (2-methoxy-4,6-*bis*(isopropylamino)-*s*-triazine), and diuron (*N*-(3,4-dichlorophenyl)-*NN*-dimethylurea), the last two proving the most effective as pre-emergence treatments.

Based on these results the use of diuron, the more widely available chemical, at 3/4 lb of commercial formulation per acre (approximately 10 oz a.i.), has now become standard weed control practice. Over 100% yield increases are