

PLANT PRODUCTION AND PLANT PROTECTION CHEMICALS

SCOPE OF FERTILIZER-PESTICIDE MIXTURES

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IN the modern strategy for agriculture, where maximum output per unit area per unit time is the immediate need, the role of plant production and protection chemicals needs no emphasis. Constituting the plant production chemicals, not only the major nutrients but also the micronutrients assume critical position in intensive agriculture. The increased use of fertilizers has enhanced the susceptibility of plants to diseases and pests and therefore the proper use of plant protection chemicals along with plant production chemicals becomes inevitable. As such with the increase in the use of fertilizers, the use of pesticides is bound to increase. The fertilizer pesticide ratio has not so far reached the optimum level and it would narrow down in future when the use of pesticides becomes more.

Fertilizer Pesticide Mixtures

Both the fertilizers and pesticides are costly inputs; the pesticides being costlier because of their imported character and also high cost of production. The economy in the use of these chemicals will be very much appreciated. Recently, the use of fertilizer-pesticide mixtures for their efficient and economic use has focused the attention of various workers in the field. The first attempt in this direction may be traced back to 1904, when in France a patent was granted for the mixture of fertilizer and pesticide. Since then a number of patents have covered the efficient combinations of fertilizers and pesticides. Mostly the chlorinated hydrocarbon group of insecticides like DDT, BHC, chlordane, heptachlor, aldrin and dieldrin have been used in such combinations. Also, sometimes fungicides and herbicides used in combination with fertilizers give spectacular results. These mixtures especially the mixtures of fungicides and herbicides with fertilizers as foliar spray have ample scope in dry land farming, where soil application of fertilizers cannot be useful. Also, the fertilizer urea combined with herbicides like 2, 4-D

(2, 4-dichlorophenoxyacetic acid) gives significantly higher yields when used as foliar spray.

The combinations of fertilizers and pesticides are available as granules, solution in low viscosity solvents, emulsifiable concentrates and even as water dispersible powders. In India recently M/S Hindustan Insecticides Ltd., New Delhi and the Fertilizer Corporation of India have collaborated to manufacture mixtures of urea and DDT.

Use of fertilizer-pesticide mixtures has a great scope in agriculture but there are a number of problems associated with their use and a few of these are enumerated below.

Compatibility of fertilizer with pesticide limits the number of combinations. All fertilizers cannot be made in mixture with a number of pesticides e.g., chlorinated hydrocarbons like DDT, BHC, aldrin, etc., cannot be mixed with or formulated with alkaline or physiologically alkaline fertilizers because such mixtures result in the hydrolytic breakdown of these insecticides. We have to take into consideration the properties of both fertilizers and pesticides, their mode of action and form of the formulation.

Sometimes the crop may require the pesticides and not the fertilizer and vice versa. In both these cases the mixtures may neither be an economical proposition nor safe. This requires therefore the survey and forecast of the fertilizer needs of the crops and their susceptibility to diseases or pests before recommending different mixtures for different crops under different agro-climatic conditions.

It is not always very easy to obtain a uniform mixture of fertilizers with pesticides because of the small amounts of the latter required to be added in large amounts of the former. This also makes it rather difficult to make guarantees of the proportions of the components of such mixtures and may thus affect the commercial values of the product.

TABLE 1 EFFECT OF INSECTICIDE APPLIED WITH STARTER FERTILIZER ON ROOT WORM CONTROL OF CORN

Treatment	Rate of insecticides lb/acre	Lodging at harvest (45° angl.)	Yield of bushell/acre
Fertilizer alone	—	30 0	71 3
Fertilizer + aldrin	i) 0 25	9 9	93.0
	ii) 0 50	11.8	104.5
	iii) 1 00	8 6	107 0
Fertilizer + heptachlor	i) 0 25	10.6	104 0
	ii) 0.50	3.3	110.0

Residual Effects

Sometimes these broad spectrum persistent insecticides can have far-reaching effects on beneficial arthropods which may not be the immediate targets of the pesticides. For instance population balance between predaceous and deleterious-feeding insects can be very much altered by chlorinated hydrocarbon insecticides and this may have its side effects on soil structure and possibly soil fertility. So the residual effects of these pesticides are to be critically examined, before using such combinations. These residues should not persist much to disturb the biology of the soil e.g., DDT is known for its persistence and BHC imparts musty odour when used on food crops. The combination should be nominally persistent and should not impart any bad quality to the crops due to residual effects.

We have to consider the morphology of the insect to be controlled, its stage of development and intensity of infestation before recommending such combinations with regard to the amount of insecticide selected to be applied in the mixtures.

The major difficulty is faced in the mode of application of these mixtures. While fertilizers may give best results when applied in soils in bands, such information as regard to combinations of fertilizers and pesticides is scanty and fragmentary. However, placement below the roots of the plants of the mixture may not give protection to the roots. Foliar application of combinations of fertilizers with fungicides or herbicides seems to be the most efficient use of both fertilizers and pesticides.

Keeping in view the above mentioned problems and others it is easy to add the desired amounts of pesticides to fertilizers and use them whenever and wherever required. The systemic pesticides have a promising future in such combinations. Nitrogenous and potassic solutions with fungicides and herbicides specially made up for the crop concerned show promise.

Although much critical research work has not been done with such mixtures, these would definitely be an economical corollary in dry land farming areas, where

these may be applied as foliar spray. We need thorough studies and field trials before recommending their use to farmers. These mixtures, no doubt will save on transport and labour application cost. An excellent example of the use of such combinations is shown by the work of Apple (1957). He found the combinations of insecticides (aldrin and heptachlor) with starter fertilizer not only to be effective in the control of root-worm of corn but also increase the crop yields and reduce lodging. His data are shown in Table 1.

CONTINUED FROM PAGE 22

FORAGE LEGUME FOR ARID ZONE

liked by sheep and cattle and not by goats. Sheep liked to eat the pods in preference to leaves. Stems were ungrazed. Cattle would eat the entire plant. The dry matter content of leaf, stem and pod of the plant at the podding stage was 19, 21 and 22 per cent respectively. The crude protein content was 17.3, 8.1 and 23.4 per cent in the leaf, stem and pod respectively.

Self-regeneration under pastoral condition. *Dolichos lab lab* var *lignosus* once established in sandy or sandy loam soil of the arid zone could propagate itself by self seeding provided the crop was utilised moderately and grazing or cutting was done in autumn (September-October) only. Light harrowing between the rows in the next season during monsoon ensures better germination of seeds. The *ballar* plants normally continued to grow for two years and as such it was classed as a biennial crop. But there were some hardy plants which could continue to grow for several years also and selection of these plants for their drought hardiness may be effective.

Seed production and viability. *Ballar* crop yields about a quintal of seed per hectare in two three pickings, in the first year during the months of November-December. Seed production is reduced by half if the crop is utilized for grazing or cutting. The seeds remain viable in storage for a number of years.

Diseases and pests. Although root rot, rust, anthracnose and dieback diseases and caterpillar grass hopper and aphid pests have been reported from elsewhere, no serious pests or diseases has been observed so far in this crop under arid and semi-arid conditions of Rajasthan. Insect pests may, however, be controlled by spraying of Dimecron emulsion.