THE PLACE OF HERBICIDES IN THE POTATO CROP

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SUMMARY

Cultivation of potato fields after planting is shown to be primarily for weed control and only of limited benefit to the crop itself. Yields have often been reduced by an excessive number of post-planting cultivations. The conventional management system using frequent post-planting cultivations has the disadvantage of increasing the spread of potato virus X, encouraging the formation of stable soil clods in the ridges by the passage of implements, and increasing susceptibility of the crop to frost after emergence. Moreover, the need for inter-row cultivation imposes a limitation on the spatial arrangement of plants in the field.

The potato is highly susceptible to weed competition, but comparatively indifferent to the degree of post-planting cultivation. If herbicides are to replace cultivation as a method of weed control they must be effective and leave no toxic residue in the tubers. Suitable herbicides, many of them mixtures, have been found and specific local recommendations have been made. No single herbicide or mixture of herbicides is likely to be successful under the wide range of growing conditions and weed problems met in practice. The implications of replacing cultivation with herbicides are being widely investigated but so far no alternative to the system of plant arrangement in standard use has shown an outstanding advantage.

1. INTRODUCTION

Over 10 years ago ALDRICH and CAMPBELL (1952), working in New Jersey, showed that the greater part of the intensive post-planting cultivations normally associated with the potato crop could be dispensed with if herbicides were used. Some 5 years later in Germany, RADENMACHER (1957) described the way in which chemical weed control could be integrated with older method of husbandry. Interest in these developments was not aroused in Britain until it was discovered that hard soil clods, which are the most difficult part of the soil to separate mechanically from potato tubers, are formed largely as a result of post-planting cultivations (N.I.A.E., 1958–59). Experiments at several centres in Europe continued (PATZOLD, 1959; ROBERTSON 1960a and b; WOOD, SUTHERLAND and STEPHENS, 1960), and many workers have now described the successful substitution of herbicide treatment for post-planting cultivation, sometimes with an increased yield. In consequence there is now considerable interest amongst potato growers in the use of herbicides such as linuron, monolinuron, a commercial mixture of simazine with prometryne, paraquat, diquat, and various formulations of dinoseb.

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Such a major change in husbandry cannot be considered in isolation, because the management and spacing of the crop has been influenced for so long by the need for post-planting cultivations to control weeds. In the following account some of the implications of adopting herbicides are considered. Chemicals used for haulm destruction and growth regulators applied to the foliage at low concentrations to modify plant growth are not discussed.

2. THE HARMFUL EFFECT OF WEEDS ON THE CROP

Many authors have shown that weeds compete effectively with potatoes for water and nutrients, and if not controlled, yields may be severely reduced (NEILD and PROCTOR, 1962; STEPHENS, 1962, 1964; INGRAM, 1964; GREIG and AP-TIKRITI, 1962; BECKER, 1962). BURGHAUSEN (1963a) suggests that the competitive effect of weeds depends on the predominant species present. Specific interactions between certain weed and crop species (including potatoes) have been demonstrated in water culture (MARTIN and RADEMACHER, 1960), but the importance of these phenomena in the field is unknown. Since most annual weeds germinate near the surface (CHANCELLOR, 1964), they are unlikely to affect the crop until after it has emerged: PEREIRA (1941) has shown, however, that even if the weeds present at emergence are very small they can still cause a reduction in yield. Once well emerged and growing actively, potato plants seem to be rather less susceptible to weed competition than at the time of emergence (VAN HIELE, 1952; KAWATEI, KITANO and SHIRASAWA, 1958). In practice it is rarely possible to achieve complete weed control by cultivation for a variety of reasons including bad weather, and NEURURER (1961a) estimates that potato yields in East Germany could be increased by 10% if weed competition could be eliminated by improved methods of husbandry.

A tangle of weeds during lifting can increase the number of tubers left in the ground (FISCHNICH, 1958), increase mechanical damage (SAWYER and DALLYN, 1963), and increase the time taken to lift the crop (NATION, 1961). Furthermore, tubers may be pierced by rhizomes of couch grass (Agropyron repens), Bermuda grass (Cynodon dactylon), or nut grasses (Cyperus spp.) (ENNIS, SHAW, DANIELSON, KLINGMAN and TIMMONS, 1963).

The soil-borne tobacco rattle virus (TRV), the causal agent of spraing and stem mottle, is carried in the seeds of some weed species. Seedlings from virus-infected seed could serve as the source from which nematode vectors obtain TRV and transmit it to healthy potato plants in the field: weeds may also be of importance in the spread to potatoes of the tomato black ring virus (CADMAN, 1963).

3. THE NEED FOR CULTIVATION AFTER PLANTING

Successful potato growing has been associated with frequent post-planting cultivations, and ALDRICH, BLAKE and CAMPBELL (1954) estimate that during a season there may be up to 25 miles of tractor travel per acre (including spraying and harvesting). SANDERS (1957), in a standard British textbook, stresses that thorough cultivation,