THE EFFECT OF NITROGENOUS FERTILIZERS ON THE YIELD OF DIRECT - DRILLED RAPE

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Summary

Rape and white clover (*Trifolium repens*) were direct-drilled together into grass-dominant pasture, treated with paraquat, to provide grazing for lambs and as a method of introducing clovers for improved pasture. Yields of rape in two trials were low, with no significant response to added nitrogen. Yields were high and unaffected by added nitrogen where rape was drilled into treated barley grass (*Hordeum murinum*). In all trials white clover establishment was satisfactory.

INTRODUCTION

For the successful establishment and growth of brassicas drilled in spring or early summer into chemically-treated pastures, it has been found necessary to control all plant species and in some conditions the addition of nitrogenous fertilizer markedly increased yield (Taylor, 1967). In some trials, rape was direct-drilled into ryegrass (*Lolium* spp.)/white clover (*Trifolium repens*) pastures. Under a wide range of conditions, however, the recovery of clover following the application of paraquat at 2 to 4 oz to pasture can provide grazing for fattening lambs equivalent to rape and probably at lower cost (Taylor and Arnst, 1968). Three trials were carried out, under conditions where perennial clovers were not evident to any great extent, to compare the effects of nitrogen applied at different rates and in different forms to direct-drilled rape and to investigate the establishment of perennial clovers drilled with the rape as a basis for subsequent establishment of improved pasture.

METHODS

Paraquat was applied to pastures, close-grazed by sheep, in 20 to 30 gal of water per acre. A few days after spraying, rape (Aphid Resistant or Rangi) and white clover seed were mixed and drilled at 3½ lb and 3 lb per acre, respectively, with a Duncan 700 Seedliner fitted with direct-drilling points. Superphosphate was applied at 1½ cwt per acre at drilling and the following treatments were subsequently compared:

1. No nitrogen
2. 20 lb nitrogen as ammonium sulphate (21% N)
3. 40 lb nitrogen as ammonium sulphate (21% N)
4. 60 lb nitrogen as ammonium sulphate (21% N)
5. 40 lb nitrogen as urea (46.4% N)
6. 40 lb nitrogen as di-ammonium phosphate (18% N. 21% P).

Treatments were broadcast over plots 9 ft x 9 ft or 9 ft x 18 ft. An area 3 ft x 3 ft was sampled and the fresh weight of rape recorded. Rates of herbicide are expressed in terms of active ingredient per acre.

TRIAL DETAILS AND RESULTS

Brief details of the trials are given in Table 1.

TRIAL R1 (PENDARVES)

The pasture at the time of spraying comprised mainly subterranean clover (*Trifolium subterraneum*), suckling clover (*Trifolium dubium*), browntop (*Agrostis tenuis*) and hairgrass (*Vulpia dertonensis*), with some perennial ryegrass (*Lolium perenne*), white clover and flat-weeds.

Rape and clover germinated rapidly in moist soil conditions. Subsequently, the growth rate of direct-drilled rape and an adjacent cultivated crop was severely affected by dry weather. At the time of sampling, both direct-drilled rape and an adjacent cultivated crop were stunted: subterranean clover had germinated and was the main weed in both areas. White clover direct-drilled with the rape was evenly established. The fresh weight yields were very low and variable and the apparent differences in yield, shown in Table 2, although not significant, suggest that phosphate availability was limited. The yield of cultivated rape was 2.17 tons per acre.

TRIAL R2 (AMBERLEY)

An area of about 8 acres of pasture varying in composition from a mixture of perennial ryegrass and white clover to entirely barley grass (*Hordeum murinum*) depending on aspect was sprayed with paraquat at 8 oz on September 21. Because the spray pattern was deflected by high winds during spraying, the major part of the area was resprayed at the same rate on September 27.

Rape and clover were drilled and the fertilizer treatments subsequently applied to an area which was predominantly barley grass at the time of spraying. Rape and clover germinated evenly; growth of rape was restricted over limited areas where perennial clovers recovered from the application of paraquat. The fresh weight yield of rape was much higher than in Trial R1 (Table 2) with no indication of a response to nitrogen added alone or in combination with phosphate.

TABLE 1: DETAILS OF TRIALS

	<i>R1</i>	<i>Trial No.</i> <i>R2</i>	<i>R3</i>
Location	Pendarves	Amberley	Weedons
Soil type	Hatfield silt loam	Waipara silt loam	Hatfield shallow sandy loam
Pasture composition	Mixed species	Barley grass	Hairgrass
Rate of paraquat	16 oz	2 x 8 oz	8 oz
Paraquat applied	Sep. 19	Sep. 21 & 27	Oct. 26
Crop drilled	Oct. 5	Oct. 2	Oct. 28
Nitrogen applied	Nov. 20	Nov. 21	Nov. 29
Crop sampled	Jan. 11	Jan. 12	Not sampled

TABLE 2: EFFECT OF NITROGENOUS FERTILIZER ON THE YIELD OF DIRECT-DRILLED RAPE

Treatment	Rate of N (lb./acre)	Form of Nitrogen	Yield of Rape (tons fresh weight/acre)	
			R1 Pendarves	R2 Amberley
1.	0	—	1.41	22.0
2.	20	Ammonium sulphate	1.58	19.4
3.	40	Ammonium sulphate	1.56	22.7
4.	60	Ammonium sulphate	1.68	23.1
5.	40	Urea	1.55	21.7
6.	40	Diammonium phosphate	2.11	22.0

After grazing, rape and clovers recovered rapidly to provide further grazing comprising about one-third white clover with two-thirds rape, thus indicating good establishment of drilled clovers. After further close grazing, winter-feed grasses and cereals were direct-drilled, at which time occasional plants of barley grass had germinated. No plants could be found in the area used for a trial the previous year and reported earlier (Taylor, 1967).

TRIAL R3 (WEEDONS)

Rape and clover were direct-drilled under dry soil conditions into pasture, almost entirely hairgrass, sprayed with paraquat at 8 oz. Continuing dry weather appeared to severely limit germination and early growth. Following an apparent lack of response to the addition of fertilizer and poor growth of rape, the trial was abandoned. However, by February the recovery of established clovers and the establishment and growth of drilled white clover provided appreciable grazing for sheep. Grasses and a cereal were direct-drilled in autumn to provide winter feed.

DISCUSSION

In the two trials carried out on the Hatfield soil, the growth of rape was severely limited by factors other than nitrogen availability, partly phosphate but more importantly water supply. Where cultivation destroys pasture and reduces water loss by evapotranspiration, sufficient moisture may be retained in the soil for germination and growth of crops sown in early summer. Where a crop is direct-drilled, removal of soil moisture by pasture species continues up to a few days before drilling, thus it is probable that, in areas of high summer evaporation and low rainfall, direct-drilling must be carried out in spring when soil moisture is adequate and not at a later time as in Trial R3 (Weedons). In this respect, however, white clover appears better adapted to growth under dry conditions than rape.

Barley grass is commonly found in areas of generally high soil fertility and hence the lack of response to added nitrogen at Amberley was to be expected. If clover can be established in such areas, the application of paraquat followed by direct-drilled rape in two successive seasons could be a suitable method for replacing barley grass with clovers without the destruction of established clovers and detrimental effects of cultivation on soil structure.

In the present trials, nitrogen was broadcast as a solid fertilizer after drilling. For optimum results, nitrogen should be applied in the drill row at drilling, provided germination damage can be avoided.

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