THE DEVELOPMENT OF MACHINE METHODS FOR EXTENSIVE ONION CROP PLANTING

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Summary

A trial was carried out to determine the reliability of present herbicides on onions when applied to pelleted and precision drilled onions for optimal yield and quality. Propachlor and cypromid mixtures gave good weed control, a decrease in onion plant numbers, a tendency for early bulbing, and increased disease. These factors did not affect total yields over controls or other herbicides but did influence the grading of the onions.

INTRODUCTION

THE ADOPTION of precision drilling of many vegetables depends on complete weed control. Precision drilling, or the precise placement of single seeds, allows optimal placement for quality and yield in rows that are not suitable for mechanical or hand-weeding. Seeds are often pelleted for precision drilling and this can result in sowing depths for optimal emergence being less deep which could influence herbicidal action on growth.

Experiments were designed to test these various factors in extensive onion production. Those treatments that are pertinent are listed below:

- A—Pelleted seed sown at ½ in. depth.
- B—Pelleted seed sown at 1 in. depth.
- C—Bare seed sown at 1 in. depth.

Each of these onion treatments was subdivided into 4 herbicidal sub-treatments (all rates in active ingredient per acre):

1. Pre-emergence—chlorpropham, 2 lb paraquat ½ lb
Post-emergence—linuron ½ lb (a common commercial herbicide treatment for onions)
2. Pre-emergence—chlorbufam/pyrazon 1.8 lb
Post-emergence—chlorbufam/pyrazon 1.8 lb
3. Pre-emergence—propachlor 4 lb
Post-emergence—propachlor 4 lb, cypromid 5 lb
4. Control—hand-weeded control.

All sub-treatments were replicated three times. Total numbers have been used unless otherwise indicated. Each replicate consisted of a plot 12 ft×5 ft in which only 10 ft of the three centre rows out of a total of five were recorded. All seeds were sown on September 15, which is late for this district.

Pre-emergence sprays were applied on September 20.

Post-emergence sprays were applied (a) chlorbufam/pyrazon on October 23, (b) propachlor/cypromid and linuron on November 23.

RESULTS

EFFECT OF HERBICIDES ON WEED AND ONION PLANT POPULATIONS

There is no doubt that propachlor was the most effective weedicide in these treatments but it should be noted that manipulation of application times and rates of the other herbicides could improve their effectiveness. However, a wide latitude in application times and rates of any herbicide is important and the propachlor and propachlor/cyromid mixtures appear to allow for this.

The wellbeing of the onion plant itself is just as important as control of the weed population. No growth suppression of onions was apparent in the first 3 weeks after application of any weedicide (Table 1) but deaths occurred later, especially in sub-treatments 2 and 3 (chlorbufam/pyrazon and propachlor) (Table 2). This was aggravated by heavy November rains. Despite this toxicity, propachlor caused earlier bulbing (Table 3) than all other, treatments including hand-weeded controls.

TABLE 1: WEED AND ONION POPULATIONS 3 WEEKS FOLLOWING PRE-EMERGENCE APPLICATIONS OF HERBICIDES

					<i>Herbicide Treatments (irrespective of pelleting or depth of sowing)</i>			
					1	2	3	4
Onion count*	....	....	....	....	375	410	329	349
Weed count†	....	....	....	....	1,041	1,071	222	1,410

*Onion count = Total plants from 6 random 10 in. row lengths per plot.

†Weed count = Total weed nos. in 6 random 100 sq. in. areas per plot.

Note: Size is not indicated here—weeds under treatment 4 larger than 1 & 2.

TABLE 2: WEED AND ONION POPULATIONS FOLLOWING POST-EMERGENCE HERBICIDE APPLICATIONS AND 1st HAND-WEEDINGS IN TREATMENTS 1, 2 & 4

					<i>Herbicide Treatments (irrespective of pelleting or depth of sowing)</i>			
					1	2	3	4
Onion count	....	....	....	....	334	296	156	291
Difference from Table 1	....	....	....	....	-41	-114	-173	-58
Weed cover (%)	....	....	....	....	34	32	12	12

TABLE 3: HERBICIDAL EFFECT ON BULB SIZE IN JANUARY

					<i>Herbicide Treatments (irrespective of pelleting or depth of sowing)</i>			
					1	2	3	4
Total means of accumulated bulb diameters in in.	....	....	....	....	9.6	9.7	13.9	11.8

EFFECT OF HERBICIDES ON ONION YIELDS

Only Treatment 1 appeared to reduce the total yield of onions below those of the hand-weeded control (Table 4), while Treatment 3 was the only herbicide to affect the numbers making up that total weight (Table 5). The composition of the yields and the numbers of onions composing those yields, however, was different for each herbicide.

It is clear from Tables 4 and 5 that Treatment 3 (propachlor/cypromid) had reduced plant numbers and thus increased the numbers and weight of bulbs in Grade A owing to reduced competition in a weed-free environment. Herbicides 1, 2, and control maintained similar plant populations but bulb size was retarded by inadequate weed control (Treatments 1 and 2) and possible herbicide suppression.

In Table 6 the non-marketable bulbs are also recorded and Treatment 3 (propachlor/cypromid) application caused a significant increase in this category over all other treatments. This was due in large part to diseased

TABLE 4: WEIGHTS OF ONIONS IN 3 MARKET GRADES RECORDED IN LB.

(Respective % of total yield in parentheses)

		<i>Herbicide Treatments (irrespective of pelleting or depth of sowing)</i>			
		1	2	3	4
Onion Grades					
A	....	45.1 (35.1)	62.7 (44.1)	87.0 (57.2)	83.7 (51.6)
B	....	54.7 (42.6)	57.4 (40.3)	50.7 (33.3)	61.5 (38.0)
C	....	28.7 (22.3)	22.3 (15.6)	14.4 (9.5)	17.1 (10.4)
Totals	....	128.5	142.4	152.1	162.3

Grade A: above 2 in. in diameter.

Grade B: between 1½ and 2 in. in diameter.

Grade C: below 1½ in. in diameter.

TABLE 5: NUMBERS OF ONIONS IN 3 MARKET GRADES

(respective % of total numbers in parentheses)

		<i>Herbicide Treatments (irrespective of pelleting or depth of sowing)</i>			
		1	2	3	4
Onion Grades					
A	....	194 (14.5)	280 (21.6)	346 (32.4)	350 (28.0)
B	....	500 (37.5)	493 (38.0)	429 (40.2)	527 (42.2)
C	....	640 (48.0)	538 (41.5)	292 (27.3)	369 (29.5)
Total	....	1,334	1,311	1,067	1,246

TABLE 6: WEIGHTS AND NUMBERS OF REJECT ONIONS

		<i>Herbicide Treatments (irrespective of pelleting or depth of sowing)</i>			
		1	2	3	4
Wt. rejects (lb)	....	12.3	15.3	30.3	17.2
No. rejects	....	144	184	283	184

TABLE 7: ANALYSIS OF VARIANCE—DUNCAN'S TEST FOR SELECTED DATA ON 12 TREATMENTS

Treatments		Means, Onion Count		Means, Bulb Size		Means, Weight		
		Jan. 11, 1968		Jan.		Grade C		
		Oct. 12, 1967	Jan. 11, 1968	Jan.	Jan.	Grade A	Grade C	Rejects
A 1	Herbicide	1 46.33 abcAB	35.33 abAB	1.36 abc		4.41 cdAB	2.66 bcdBC	2.83 bcdABC
A 2	"	2 47.00 abcAB	39.00 abAB	1.36 abc		4.99 bcdAB	2.91 bcBC	2.25 bcABC
A 3	"	3 42.33 abcABC	40.00 abAB	1.63 ab		8.22 abcdAB	1.91 cdefBC	5.33 aA
A 4	"	4 44.00 abcAB	36.33 abAB	1.56 abc		7.25 abcdAB	1.91 cdefBC	4.00 abAB
B 1	"	1 26.00 dC	23.66 bB	1.20 C		7.83 abcdAB	1.58 cdefBC	0.50 eC
B 2	"	2 34.33 cdBC	22.33 bB	1.16 c		9.49 abcAB	1.04 defC	1.16 deC
B 3	"	3 26.66 dC	24.66 bB	1.73 a		11.75 aA	0.58 fC	2.00 cdeBC
B 4	"	4 26.33 dC	23.33 bB	1.16 c		10.58 abA	1.41 cdefBC	0.58 eC
C 1	"	1 52.66 abA	52.33 aA	0.63 d		2.75 dB	5.33 aA	0.66 eC
C 2	"	2 55.33 aA	37.33 abAB	0.70 d		6.41 abcdAB	5.83 abAB	1.66 cdBC
C 3	"	3 40.66 bcABC	24.00 bB	1.26 bc		9.00 abcAB	2.33 bcdeBC	2.75 bcdABC
C 4	"	4 46.00 abcAB	37.00 abAB	1.20 c		10.08 abAB	2.41 bcdeBC	1.16 deC
CV		16.8%	28.7%	17.3%		37.2%	39.4%	49.0%

bulbs which appeared to be a result of early bulbing die-back in this treatment several weeks earlier than in other plots, giving a larger exposure to pathogens. This is consistent with the degree of infection caused by early bulbing in plants sown at 1/2 in. depth.

INTERACTION BETWEEN HERBICIDES, PELLETING AND DEPTH OF SOWING

Selected interactions and analyses of variance using Duncan's test are given in Table 7.

From the analysis, no herbicidal effect is visible on either of the onion counts. Other factors are responsible for the reduced onion counts under B treatments and also under the A treatment in the count of January 11, 1968.

The stimulation of bulb size and earliness of bulbing is apparent consistently in all the main treatments and reached its greatest significance in pelleted seed sown at 1 in. depth. The effect of this can be traced again through all the main treatments where grade is involved. Consistently, propachlor/cypromid treatments produced a larger percentage of good grade onions and a lower percentage of low grade onions. Consistently seen also is the increased weight of rejects with this treatment which can be related back to early bulbing in January. The relationship of early bulbing and rejects under main treatment A is also evident.

CONCLUSION

Under the conditions of this trial, the following significant facts are indicated:

- (1) Depth of sowing did not influence susceptibility of onions to herbicides.
- (2) Pre-emergence herbicides did not affect the initial emergence of onion plants.
- (3) Counts taken after post-emergence applications of herbicides indicated some effect upon plant numbers, especially from Treatment 3 (propachlor/cypromid).
- (4) The best and widest spectrum of weed control was given by Treatment 3.
- (5) Treatment 3 appeared to stimulate early maturity of the onion.
- (6) This early maturity was thought to have increased disease incidence.
- (7) It was considered that there might be a direct effect of Treatment 3 in increasing disease incidence.

Although treatments did not influence total yields to a great extent, the composition of the yield was markedly changed. In Treatment 3, greater proportions of the yield occurred in the higher grades than in the lower compared with other herbicide treatments.

The trial has indicated that it is not enough that a herbicide should control a range of weeds. It must control those weeds with an efficiency that precludes the falling back on to mechanical and hand-weeded control as a result of unforeseen delays and contingencies. In addition, a knowledge of the effect on the crop must be known to enable precision growing to develop confidently. A reduction in plant numbers may not decrease the yield, but it can alter the yield composition significantly.

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