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Production of Onion Seedlings as Influenced by Different Sowin Methods and Weed Pressure

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Abstract: An investigation was made to observe the influence of sowing methods and duration of weed competition on the production of onion seedlings. The experiment was laid out in split plot arrangements with Randomized Complete Block Design (R.C.B.D.). The data were recorded on the weed density/m^2, weed density (%), weed biomass/m^2, weed dry weight percentage, germination percentage, number of Onion seedlings and seedling weight. Sowing methods produced significant results in case of germination percentage. Statistically line sowing (7.54 kg) and weed free after 10 days of sowing (8.40 kg) produced maximum seedling weight/plot. As regards the weed density, the highest density of *Convolvulus arvensis* was recorded in the treatments. Besides, *Euphorbia heliscopia, Chenopodium album* and *Rumex crispus* also retarded the growth rate of onion seedlings.

Key words: *Allium cepa*, onion seedlings, production, weeds

Introduction

During the years of short supply of onions in the country, the nation has been spending thousands of dollars from the hard to earn foreign exchange, on the import of onions. The Onion (*Allium cepa* L.) belongs to the family Liliaceae or lily family. There are about 300 widely scattered species in the genus *Allium* and many of them have the characteristic onion flavour and odour. Besides providing nutrition, it imparts acceptable flavour to our dishes. Due to its enormous consumption, onions occupy a pivotal position both in acreage as well as production among the vegetables. Onions can be grown in plains as well as hilly areas. The yields of onions realized in Pakistan are too low as compared to the advanced agricultural countries of the world. The major reason for the poor yield of onions is the excessive weed competition. Onion is a crop to which weeds pose a serious threat by depriving the crop plant of nutrients, light, moisture and carbon dioxide. No studies under local conditions have been undertaken to investigate success of different planting methods and the most critical weed competition periods in onions nursery. Yields were severely reduced by partial weed competition in onions. Cultivation and weeding have been reported to amount 40% of the total cost of production (Lockman, 1953). The period from emergence to 4 weeks later was the most critical for competition (Shadbolt and Holm, 1956). Weed control constitutes one of the principal costs of production in onions (Nyland *et al*., 1958). Roberts (1973) concluded from his studies that onions need to be kept weed free for 12 weeks after emergence due the lack of vigorous foliage and inability to recover from competition. Thomas and Wright (1984) studied the influence of weed competition on onions. The studies showed that the crop was the most sensitive at the early stages of its growth. Bannaon *et al*. (1988) concluded that onion yields were reduced by 62.91 and 99%, if weeds were allowed to persist for 2 and 3 weeks, respectively. Manjunath *et al*. (1989) reported that the presence of weeds affected plant height, bulb diameter, harvest index, bulb dry weight and bulb yield. Only 1.54 t ha^{-1} were harvested in unweeded check as compared to 28.9 t ha^{-1} in weed free check and 33.87 t ha^{-1} in fluazifop butyl treated plots at 0.5 kg ha^{-1}. Warid and Loaiza (1993) concluded that the yield of transplanted onions was higher as compared to the direct sown crop. Ahmed *et al*. (1994) evalulated Tribunil 70 WP, Ronstar 12 L and Probe 75 WP for controlling weeds of onion in D.I. Khan. Onions are the most non-competitive species to weeds. For acheiving their higher economic yields, the weed free conditions are required to be maintained either mechanically or chemically (Huda, 1997). The lesser time to germination was availed by the line sowing method as compared to the broadcast method (Ghafoor *et al*., 2000). Keeping in view the importance of the subject, the present investigations were initiated to decipher the most critical periods of weed competition with planting regimes of onions nursery.

Materials and Methods

An experiment was conducted on onions growth in its nursery phase as affected by planting methods and weed pressure at the Faculty of Agriculture, Gomal University, D.I. Khan.

The experiment was laid out in a split-plot in randomized complete block design with three replications. The main plots comprised the sowing methods while the weed pressures were assigned to the sub-plots. The sub-plot size was kept at 2.5×2 m^2. Ranting was done during the first week of November. The protocol of the experiment is detailed as under:

Main-plots: Sowing methods

1) Line sowing (rows spaced at 10 cm)
2) Broadcast

Sub-plots: Weed competition periods

1) Weed free throughout the crop-season (check)
2) Weed free from 10, 20, 30, 40 and 50 days after emergence of the crop

Onions seed were sown on flat seed beds with the respective methods. The planting was done manually by using equal quantity of seed in both methods. The seeds were covered either with sand or farmyard manure after planting with both methods. Standard agronomic practices such as irrigation, fertilizer application etc. for the onion crop were maintained constantly for all the treatments. Swat-I cultivar of onions was employed in the studies. The data were recorded for Weed density/m^2, Weed density (%), Weed biomass/m^2, Weeds dry weight percentage, Germination percentage, Seedling weight (kg/plot), Number of Onion seedlings. The data of all the above

Table 1: Effect of planting methods and weed competition periods on the onion seedlings. Mean Weed density (Number-wise) and (Percentage wise)

English Name Vernacular Name	Botanical Name	Life Cycle	Weed Density	
			No. m^{-2}	%age
Common Lambsquartere (Bathu)	*Chenopodium album*	Annual	7.58	14.93 B
Field Bindweed (Vanverhi)	*Convolvulus arvensis*	Perennial	12.3 A	36.99 A
Johnson grass (Darab)	*Desmotachya bipinnata*	Perennial	5.63 C	10.01 BC
Camel's thorn (Jawanh)	*Alhagi camelorum*	Perennial	4.44 CD	10.73 BC
-(Pitpapra)	*Fumaria polymorpha*	Annual	2.98 D	8.33 C
Curly dock (Khatak)	*Rumex crispus*	Annual	4.00 CD	9.05 C
Leafy Spurge (Zeller Booti)	*Euphorbia heliscopia*	Annual	2.96	6.53 C
Indian Clover (Senji)	*Melilotus parviflora*	Annual	2.81 D	5.95 C

Mean Weed biomass (g m^{-2}) and Mean Dry Weight (%)

English Name Vernacular Name	Botanical Name	Life Cycle	Weed Density	
			Biomass (g m^{-2})	Weight (%age)
Common Lambsquartere (Bathu)	*Chenopodium album*	Annual	8.31 B	18.88 8
Field Bindweed (Vanverhi)	*Convolvulus arvensis*	Perennial	21.3 A	41.30 A
Johnson grass (Darab)	*Desmotachya bipinnata*	Perennial	5.78 C	7.90 D
Camel's thorn (Jawanh}	*Alhagi camelorum*	Perennial	6.18 C	10.67 C
- (Pitpapral	*Fumaria polymorpha*	Annual	3.64 D	3.94 F
Curly dock (Khatak)	*Rumex crispus*	Annual	5.21 C	7.51 D
Leafy Spurge (Zahar Boob)	*Euphorbia heliscopia*	Annual	3.76 D	5.34 E
Indian Clover (Senji)	*Melilotus parviflore*	Annual	8.428	4.45 EF

Any two means not sharing a common letter(s) are significant at 5% level of probability

Table 2: Main effects and interaction in the effect of planting methods and weed competition periods on onion seedlings

Competition Periods	Sowing methods		Competition Period Means
	Line Sowing	Broadcast	
Germination Percentage			
Weed Free	83.500 N.S.	52.500	58.00 N.S.
Weed free 10 DAS	62.000	50.000	58.00
Weed free 20 DAS	61.000	51.385	58.19
Weed free 30 DAS	62.888	53.755	58.21
Weed free 40 DAS	81.333	50.750	56.04
Weed free 50 DAS	63.055	51.110	57.08
S. Method Means	62.258 N.S.	51.583	
Seedling Weight (kg)			
Weed Free	8.333 N.S	6.093	7.213 ab
Weed free 10 DAS	9.140	7.867	8.403 b
Weed free 20 DAS	5.687	6.367	6.027 a
Weed free 30 DAS	6.593	7.873	7.233 ab
Weed free 40 DAS	7.613	9.100	8.357 a
Weed free 50 DAS	7.880	4.153	6.017 a
S. Method Means	7.541 N.S	6.876	
No. of onion seedlings (m^{-2})			
Weed Free	105.00 N.S	112.00	108.50 N.S.
Weed free 10 DAS	111.00	100.00	105.50
Weed free 20 DAS	103.00	113.00	108.00
Weed free 30 DAS	97.00	119.00	108.00
Weed free 40 DAS	106.00	125.00	115.50
Weed free 50 DAS	98.00	120.00	109.00
S. Method Means	103.33	114.83	

Any two menus not sharing a common letter (s) are significant at 5% level of probability

detailed parameters were individually subjected to the Analysis of Variance Technique (Steel and Torrie, 1989). Subsequently, the significant means were separated by the Least Significant Difference Test by using the MSTATC computer program.

Results and Discussion

Weed Density/m^2: The weed density/m^2 for each species was computed (Table 1). Several species were uprooted from the experiment on scheduled dates in each treatment. All the species uprooted from the experiment were broadleaf except *Desmotacya bipinnata;* which is a very aggressive perennial noxious grass species. The overall means of data showed the highest number of Weeds by the *Convolvulus arvensis and* was followed the *Chenopodium album.* The other species Infesting the habitat were *Desmotachya bipinnata, Alhagi cemelorum, Rumex crispus, Fumaria polymorpha, Euphorbia heliscopia* and *Melilotus parviflora* with in the descending order (Table 1). Workers around the world (Wicks *et al*., 1973; Gaffer *et al*., 1993) have reported the occurrence of other weed species prevailing in their experiments on onions. This is plausible due to the variability in the macro and micro-ecological differences.

Weed Density (%age): The weed density (%) for each species was computed (Table 1). The persual of the percent infestation data (Table 1) also revealed a similar trend, as in weed density/m^2, in the relative infestation of species. *Convolvulus arvensis* had the maximum population, followed by the *Chenopodium album.* Almost equal infestation of *Desmotachya bipinnata* and *Alhagi camelorum* was recorded in the trail. The least percent infestation was recorded in *Melilotus parviflora.* Workers around the world (Wicks *et al*., 1973; Gaffer *et al*., 1993) have reported the occurrence of other weed species prevailing in their experiments on onions. This may be due to the variability in the macro and micro-ecological differences.

Weed Biomass (g m^{-2}): The percentage-wise distribution of the species revealed the similar pattern (Table 1). The predominant species i.e *Convolvulus arvensis* of infestation in experiment also possessed the highest biomass as well. For its perennial

life cycle, it probably was the earliest to sprout due to its rhizomes already present in the soil in the fragmented form. Hence, due to its earliest space capture it could use most of the resources of the habitat viz. nutrients, water, light and space. It was followed by *Chenopodium album* with weed biomass. Whereas the lowest weed biomass (3.64 g m^{-2}) was recorded in *Fumaria polymorpha.*

Dry weight of weeds (%): The mean dry weight of each species was converted into the percentage of the total dry weight of all the weeds. The data showed almost identical trend as for the fresh biomass as highlighted above. The *Convolvulus arvensis* has been the most aggressive to grab the available resources into its canopy. As high as 41.3% of the total dry matter assimilated by the weed species was contained by this species alone (Table 1). Another successful species of weeds in the studies was the *Chenopodium album.* It could isolate the dry matter to the extent of 18.68 percent. The weakest among the invading flora was *Fumaria polymorpha.* It could hardly gather 3.94% of the dry matter content.

Germination (%): The main effects for main plots were significant statistically, whereas the ANOVA depicted nonsignificant differences for the sub-plots. When averaged across the replications and sub-plots, the lesser germination percentage was recorded in the broadcast sown method as compared to the line sown crop. Similarly, when averaged across the replications and main-plots, no differences among weed competition periods were recorded. However, numerically the least germination was exhibited by 10 days after sowing, while the maximum germination among the subplots was recorded in the 30 days after sowing. As regards the interaction of the sowing methods with the weed competition periods, as enunciated in Table 2, all the sub-plots involving line sowing, germinated earlier. The line sowing facilitated the germination by having comparatively looser soil onto the surface, whereas in the broadcast method the chance of reaching the onion seeds to the proper moisture and tilth were minimal, hence it didn't allow the seed to germinate promptly. The highest score of germination was recorded in the Weed Free treatment u n der the Line sown method. Rao *et al*. (1986) and Subramanian *et al*. (1987) reported the superiority of transplanting method over the braodcast planting. However, identical research has not been reported in the available literature on the parameter studied.

Seedling weight (kg/plot): The main effects for main plots and their interaction with sub-plots were non significant statistically. When averaged across the replications and subplots, the lesser weight was uprooted from the line sown method as compared to the broadcast sown crop. Similarly, when averaged across the replications and main-plots, differences among weed competition periods were recorded statistically for the seedling weight (Table 2). The least weight was exhibited by weed free 50 days after sowing. However, it was statistically at par with 20, 30 and the weed free treatments. As regards the interaction of the sowing methods with the weed competition periods the differences were not real statistically, however, a spread in the data were recorded (Table 2). Shadbolt and Holm (1956), Manjunath *et al*. (1989) and Garcia *et al*. (1994) concluded the different weed competition durations as the critical for onion yield.

No. of Onion Seedlings (m^{-2}): The data of the trait under reference as detailed in Table 2 exhibited non-significant differences for the main effects for the main and sub-plots and their interaction. When averaged across the replications and sub-plots, statistically equal number of seedlings were uprooted from the line and the broadcast sown crop. Similarly, when averaged across the replications and main-plots, no differences among weed competition periods were recorded. However, numerically the least number was exhibited by weed free 20 days after sowing, whereas, the maximum number of seedlings were recorded in the 40 DAS. As regards the interaction of sowing methods with the weed competition period, the least number of seedlings was counted in weed free 50 DAS in line sowning method, while the maximum number was recorded in weed free 40 DAS with broadcast planting. Similar results were obtained by Ghafoor *et al*. (2000).

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