Indian J. Weed Sci. **41** (1 & 2) : 80-84 (2009)

Influence of Graded Levels of Nutrients, Time of N Application and Weed Management Practices on Weed Dynamics, Yield Attributes and Bulb Yield of Onion (*Allium cepa* L.)*

V. Chandrika, D. Srinivasulu Reddy, G. Karuna Sagar and G. Prabhakara Reddy
Department of Agronomy
Acharya N. G. Ranga Agricultural University, Tirupati-517 502 (A. P.), India

ABSTRACT

Field experiments were conducted at S. V. Agricultural College, Tirupati for two consecutive **rabi** seasons of 2005-06 and 2006-07 to study the influence of graded levels of nutrients, time of N application and weed management practices on bulb yield of onion. Yield attributes and bulb yield were highest with the higher nutrient level i. e. 120-60-50 kg N, P, K over the other nutrient levels. Time of N application did not exert any significant influence on bulb yield, economic returns and weed dynamics of onion. Among the weed management practices, hand weeding twice at 20 and 40 DAT significantly reduced the density and dry weight of weeds, resulting in improved weed control efficiency, elevated stature of yield attributes and higher bulb yield and it was comparable to other weed management practices. Higher bulb yield was realized even at lower level of nutrients with weed management practices.

Key words : Pendimethalin, oxyfluorfen, weed control efficiency

INTRODUCTION

Onion is the second most important vegetable and condiment crop, next to tomato. Mineral nutrition is the main factor which influences the growth and yield of onion to a large extent, since onion is known as a heavy feeder of minerals. Excessive fertilizers and delayed nitrogen application could hamper the keeping quality of onions. Hence, an adequate and timely supply of nutrients is essential for plant growth, bulb yield and quality. Onion is a very poor competitor of weeds because of its inherent characteristic traits such as short stature, non-branching habit, sparse foliage, shallow root system and extremely slow growth during initial stages. Uncontrolled weed growth reduces the bulb yield upto 40-80%, depending upon nature, intensity and duration of weed competition (Verma and Singh, 1996). Manual weeding though very effective in controlling weeds, very often is cumbersome, labour intensive, expensive and time consuming (Warade *et al.*, 2006). With the advancement in agriculture and technology, a good number of herbicides are now available, which can be used effectively and economically. Information on these aspects is lacking in the Southern Agro-climatic Zone of Andhra Pradesh, as onion is a non-traditional crop. Hence, present investigation was undertaken to optimize the suitable nutrient level and to identify an effective weed management practice for onion.

MATERIALS AND METHODS

Field experiments were conducted at College Farm, S. V. Agricultural College, Tirupati during **rabi** seasons of 2005-06 and 2006-07. The experimental soil was sandy loam, medium in available nitrogen, phosphorus and potassium contents. The treatments comprised combination of three nutrient levels [N_1 (40 kg/ha N, 40 kg/ha P_2O_5 and 30 kg/ha K_2O), N_2 (80 kg/ha N, 50 kg/ha P_2O_5 and 40 kg/ha K_2O) and N_3 (120 kg/ha N, 60 kg/ha P_2O_5 and 50 kg/ha K_2O)] and two times of N application [T_1 ($^1/_2$ basal+$^1/_2$ 30 DAT) and T_2 ($^1/_3$ basal+$^1/_3$ 30 DAT+$^1/_3$ 45 DAT) allotted to main plots and four weed management practices [W_1 (unweeded check), W_2 (hand weeding twice at 20 and 40 days after transplanting), W_3 (pre-emergence application of oxyfluorfen @ 0.24 kg/ha+hand weeding at 40 days after transplanting) and W_4 (pre-emergence application of pendimethalin @ 0.75 kg/ha+hand weeding at 40 days after transplanting)] assigned to sub-plots. The experiment was laid out in split plot

*Part of Ph. D. thesis submitted by the first author to Acharya N. G. Ranga Agricultural University, Hyderabad.

design with three replications. The variety 'Arka Pragathi' was used for the study. Entire P_2O_5 and K_2O were applied as basal and nitrogen was applied in two and three splits as per the treatments. 45-day old healthy seedlings were transplanted in the main field after giving a pre planting irrigation, and pressed gently with fingers. Oxyfluorfen and pendimethalin were applied as pre-emergence spray at recommended dose as per the treatments, one day after transplanting with a spray volume of 500 l of water/ha. Hand weedings were carried out as per the scheduled time according to the treatments. The density and dry weight of weeds were recorded at 50 days after transplanting (DAT) and at harvest using a quadrat of 0.25 m^2 from four places in each plot. The data on the weed counts and dry weight of weeds were subjected to square root transformation and the data on weed control efficiency were subjected to angular transformation and statistically analysed following standard procedure. Crop was harvested one week after observing 50% neck fall and bulbs were kept alongwith the tops and kept for seven days under shade for curing. After seven days, both the roots and tops were clipped with sharp knives leaving 2.0 to 2.5 cm neck and dried for another three days under shade till the bulbs attained constant weight and then the yield attributes and yield were recorded.

RESULTS AND DISCUSSION

Effect on Weeds

Weed flora of the experimental field comprised *Cynodon dactylon*, *Dactyloctenium aegyptium*, *Digitaria sanguinalis*, *Cyperus rotundus*, *C. iria*, *Amaranthus viridis*, *Borreria hispida*, *Cleome viscosa*, *Commelina benghalensis*, *Euphorbia hirta* and *E. thymifolia*. The experimental field was infested with sedges and broad-leaved weeds in the initial stages of the crop growth and grasses dominated at later stages. The lowest density and dry weight of the weeds were recorded with the lower nutrient level and increased significantly with the successive levels of nutrients at 50 DAT and at harvest during both the years of study (Table 1). This might be due to the fact that weeds absorb nutrients much faster than the crop in mixed vegetation. Porwal and Singh (1993) also opined that increased nutrient levels benefited the weeds more than the crop.

Time of N application significantly influenced the density at 50 days after transplanting only during the first year of study, while it had no influence on weed population during the second year of investigation. Dry matter accrual of weeds was significantly influenced by time of N application at 50 DAT, while it had no influence at harvest, during both the years of study. With regard to the weed management practices, all the weed control treatments significantly reduced the density and dry weight of weeds. During both the years of study, the lowest density and dry weight weeds were recorded with hand weeding twice, which was comparable to pre-emergence application of either oxyfluorfen or pendimethalin+one hand weeding at 30 DAT. Similar trend was observed for reduction in the density and dry weight of weeds at both the intervals of sampling (Table 1). The highest density and dry weight of weeds were observed with unweeded control during both the years of study. Hand weeding at 20 and 40 DAT might have completely removed all types of weeds including sedges, during the critical period of crop-weed competition (20-45 DAT). Pre-emergence application of either oxyflourfen or pendimethalin might have effectively hindered the germination of weed seeds and reduced the weed dynamics of grasses and broad leaved weeds effectively, but they were found to be least effective against sedges. But supplementing hand weeding at 40 DAT might have reduced the weed density and dry weight effectively.

Graded nutrient levels had no significant influence on weed control efficiency, except at 50 DAT during the first year of study. Time of N application did not exert any significant influence on weed control efficiency, except at 50 DAT, where T_1 recorded higher values over T_2 during both the years of study. At 50 DAT and at harvest, the highest weed control efficiency was found with hand weeding twice, which was, however, at par with W_3 and W_4 (Table 1). It was due to the hand weeding imposed at 40 DAT in the weed management practices and the weeds were controlled effectively as evident from reduced dry matter production of weeds. The data confirm the findings of Prakash *et al.* (2000).

Effect on Crop

The highest stature of yield attributes viz., length, weight and diameter of the bulb and the higher bulb yield was recorded with the higher nutrient level

Table 1. Effect of nutrient and weed management practices on weed density and dry matter at 50 DAT and at harvest of onion

Treatments	Weed density (No./m^2)				Weed dry matter (g/m^2)				Weed control efficiency (%)			
	50 DAT		At harvest		50 DAT		At harvest		50 DAT		At harvest	
	2005-06	2006-07	2005-06	2006-07	2005-06	2006-07	2005-06	2006-07	2005-06	2006-07	2005-06	2006-07
Nutrient levels												
N_1	6.56	7.13	9.43	9.34	6.68	6.36	10.26	10.87	56.8	57.38	47.85	43.96
	(57.50)	(65.12)	(103.87)	(99.86)	(68.74)	(67.13)	(123.01)	(131.36)	(70.41)	(70.68)	(60.21)	(54.43)
N_2	7.12	7.77	10.45	9.86	7.62	7.13	11.35	11.46	55.41	56.69	47.04	44.12
	(66.50)	(76.53)	(125.04)	(115.94)	(83.98)	(78.82)	(148.28)	(145.24)	(69.12)	(70.13)	(59.09)	(54.68)
N_3	7.71	8.91	11.43	10.42	8.58	7.83	12.44	12.28	53.78	55.79	46.16	43.52
	(76.38)	(89.70)	(147.25)	(128.78)	(100.14)	(90.00)	(175.90)	(167.09)	(67.51)	(69.45)	(57.81)	(53.55)
S. Em ±	0.081	0.359	0.044	0.062	0.013	0.078	0.080	0.096	0.135	0.516	0.540	0.404
LSD (P=0.05)	0.25	1.13	0.14	0.19	0.04	0.25	0.25	0.30	0.42	NS	NS	NS
Time of N application												
T_1	6.96	8.05	10.38	9.76	7.45	6.85	11.29	11.42	55.54	57.02	47.13	43.86
	(64.25)	(75.43)	(124.02)	(112.32)	(80.86)	(74.36)	(147.64)	(144.36)	(69.18)	(70.41)	(59.21)	(54.23)
T_2	7.29	7.83	10.50	9.99	7.81	7.37	11.42	11.65	55.18	56.22	46.89	43.87
	(69.33)	(78.79)	(126.47)	(117.40)	(87.72)	(83.00)	(150.50)	(151.42)	(68.85)	(69.77)	(58.86)	(54.20)
S. Em ±	0.066	0.293	0.036	0.050	0.010	0.064	0.065	0.078	0.110	0.239	0.278	0.330
LSD (P=0.05)	0.21	NS	0.11	NS	0.03	0.20	NS	NS	0.35	0.75	NS	NS
Weed management practices												
W_1	14.05	14.83	17.32	17.08	16.44	16.29	19.03	17.96	0.34	0.34	0.34	0.34
	(197.33)	(220.65)	(301.50)	(292.60)	(270.87)	(265.83)	(363.11)	(322.97)	(0.00)	(0.00)	(0.00)	(0.00)
W_2	4.49	5.30	7.91	7.05	4.52	3.61	8.60	9.10	74.32	77.11	63.14	59.56
	(20.00)	(20.54)	(62.55)	(49.44)	(20.60)	(13.02)	(74.80)	(83.29)	(92.58)	(94.89)	(79.49)	(74.17)
W_3	4.65	5.68	7.90	7.10	4.64	4.12	8.65	9.34	73.89	75.07	63.08	58.34
	(21.50)	(32.10)	(63.99)	(49.94)	(21.49)	(16.91)	(75.00)	(89.60)	(92.23)	(93.25)	(79.46)	(72.15)
W_4	4.83	5.94	8.02	7.62	4.67	4.41	9.01	9.73	72.89	73.96	61.50	57.23
	(28.33)	(35.16)	(73.50)	(57.49)	(24.18)	(19.28)	(83.33)	(95.71)	(91.27)	(92.21)	(77.19)	(70.55)
S. Em ±	0.120	0.372	0.071	0.192	0.053	0.155	0.152	0.301	0.364	0.477	0.582	1.107
LSD (P=0.05)	0.34	1.07	0.20	0.58	0.15	0.45	0.44	0.86	1.04	1.37	1.67	3.17

Figures in parentheses are original values. NS–Not Significant.

N_3 (120 kg/ha N, 60 kg/ha P_2O_5 and 50 kg/ha K_2O), over the other nutrient levels (Table 3). This might be presumably due to the concomitant supply of primary nutrients and translocation of photosynthates efficiently to sink. This resulted in increased weight and diameter, consequently increased the bulb yield of onion. These results are in accordance with those of Mohanty and Das (2001) and Nasreen and Hossain (2004). Time of N application did not exert much influence on yield attributes and bulb yield of onion indicating that two and three splits of nitrogen are equally effective. With regard to the weed management practices, hand weeding twice resulted in the highest stature of yield attributes (Table 3) and the highest bulb yield (Table 2), which was at par with other weed management practices. This was due to lesser crop- weed competition for growth resources, thus providing congenial environment to the crop for better expression of growth and yield. Suppression of weed competition by herbicide application was further enhanced by integrating hand weeding at 40 DAT in weed control treatments which offered efficient and prolonged weed control and kept the crop weed free during the critical periods of competition (Mondal *et al.*, 2005; Warade *et al.*, 2006). The lowest stature of all the above mentioned parameters (Table 3) was observed with unweeded check coupled with the lower level of nutrients (N_1) due to increased crop weed competition, decreased availability of growth resources to crop, leading to lesser translocation of photosynthates from source to sink. Porwal and Singh (1993) and Verma and Singh (1997) reported that there was a considerable saving of nutrients by effective control of weeds, as drain of nutrients through weeds could be arrested. Irrespective of nutrient levels, all the weed management practices recorded higher bulb yield over weedy check. Inspite of heavy fertilization, unweeded check produced the lowest bulb yield.

From the present study, it can be concluded that onion can be successfully grown in this tract with a supply of 120 kg/ha N, 60 kg/ha P_2O_5 and 50 kg/ha K_2O, applying nitrogen either in two or three splits, integrating pre emergence application of either oxyfluorfen or pendimethalin with hand weeding at 40 DAT, for achieving higher yield and quality of onion in Southern Agro-climatic Zone of Andhra Pradesh.

Table 2. Pooled mean bulb yield (t/ha) of onion as influenced by nutrient and weed management practices

	N_1	N_2	N_3	T_1	T_2	Mean
W_1	9.29	12.34	15.33	12.16	12.48	12.32
W_2	17.63	28.35	36.87	27.20	28.04	27.62
W_3	16.90	27.05	35.95	26.45	26.81	26.63
W_4	16.32	25.97	34.59	25.48	25.78	25.63
T_1	14.50	23.34	30.63	-	-	22.82
T_2	15.57	23.52	30.74	-	-	23.28
Mean	15.03	23.43	30.69	-	-	-
	S. Em±	LSD (P=0.05)		S. Em±	LSD (P=0.05)	
N	0.35	1.09	T x W	0.66	NS	
T	0.28	NS	W x N	0.84	2.41	
W	0.49	1.39	W x T	0.69	NS	
NxT	0.49	NS	N x W	0.81	2.35	

NS–Not Significant.

Table 3. Yield attributes (pooled over two years) of onion as influenced by nutrient and weed management practices

Treatments	Bulb weight (g)	Bulb diameter (cm)	Bulb length (cm)
Nutrient levels			
N_1	22.51	3.52	4.08
N_2	34.15	4.13	4.56
N_3	48.76	4.84	5.04
S. Em ±	0.48	0.053	0.057
LSD (P=0.05)	1.51	0.17	0.18
Time of N application			
T_1	34.90	4.13	4.54
T_2	35.37	4.19	4.58
S. Em ±	0.39	0.35	0.05
LSD (P=0.05)	NS	NS	NS
Weed management practices			
W_1	19.26	2.20	3.98
W_2	42.24	4.95	4.85
W_3	40.58	4.83	4.75
W_4	38.47	4.77	4.54
S. Em ±	0.85	0.05	0.08
LSD (P=0.05)	2.45	0.15	0.22

NS–Not Significant.

REFERENCES

Mohanty, B. K. and J. N. Das. 2001. Response of **rabi** onion cv. Nasik red to nitrogen and potassium fertilization. *Veg. Sci.* **28** : 40-42.

Mondal, D. C., A. Hossain and B. Duary. 2005. Chemical weed

control in onion (*Allium cepa* L.) under lateritic belt of West Bengal. *Ind. J Weed Sci.* **37** : 281-282.

Nasreen, S. and A. K. M. Hossain. 2004. Nutrient uptake and yield of onion as influenced by chemical fertilizer and organic manure. *Ind. J. agric. Res.* **38** : 164-170.

Porwal, M. K. and M. M. Singh. 1993. Effect of nitrogen and weed management on onion. *Ind. J. Agron.* **38** : 74-77.

Prakash, V., A. K. Pandey, R. D. Singh and V. P. Mani. 2000. Integrated weed management in winter onion (*Allium cepa* L.) under mid hill conditions of North-Western Himalayas. *Ind. J. Agron.* **45** : 816-821.

Verma, S. K. and T. Singh. 1996. Weed control in **kharif** onion. *Ind. J. Weed Sci.* **28** : 48-51.

Verma, S. K. and T. Singh. 1997. Effect of weed control measures and fertility on growth and productivity of rainy season onion (*Allium cepa* L). *Ind. J. Agron.* **42** : 540-543.

Warade, A. D., V. S. Gonge, N. D. Jog Dande, P. G. Ingole and A. P. Karunakar. 2006. Integrated weed management in onion. *Ind. J. Weed Sci.* **38** : 92-95.