Integrated Plant Nutrient Management for Onion Seed Production

Dev N. Tiwari[1]

ABSTRACT

Plant-nutrient management study was conducted on onion seed production through off-season bulbs in 2008 and 2009 in mid hill, Deurali, Palpa, Nepal. The aim of experiment was to identify the best combination of plant nutrient to obtain optimum seed yield of onion. Randomized complete block design was employed with three replications consisting seven combinations of organic and inorganic fertilizers along with micronutrients as treatment. A total of 42 plants of Agri Found Dark Red variety were accommodated in a unit experimental plot of 5.04 m^2 with 40cm x 30cm planting spacing. Observation was taken on number of harvested plants, days to 50% bolting and flowering and seed yield. Treatments had highly significance effects on days to 50% bolting and seed yield and days to 50% flowering was only significant. Early bolting (40.2 days) and early flowering (77 days) was observed in manure and fertilizer application of FYM 20tha^{-1} and 60:60:60kg N:P_2O_5:$K_2O$$ha^{-1}$. Delayed bolting (45 days) and flowering (80.2 days) was observed in application of FYM 20tha^{-1}. Similarly, highest seed yield of 813$kgha^{-1}$ was observed with application of 40kg $K_2O$$ha^{-1}$, FYM 20$tha^{-1}$ and 60:60kg N:$P_2O_5$$ha^{-1}$ supplemented with two sprays of Multiplex. It suggested that application of combination of organic and inorganic fertilizers accompanied with micronutrient is essential for better seed yield of onion.

Key words: Plant nutrient management, Onion seed production, Flowering, Bolting

INTRODUCTION

Onion (*Allium cepa* L.) is an important vegetable of Allium group. In Nepal, the area under onion cultivation is gradually increasing in the recent years. At present the area, production and productivity are 18,860 hectare, 246,584t and 13tha^{-1} respectively (MoAC, 2010).

Now-a-days, two distinctly different onion growing seasons are identified. Previously onions bulbs produced mainly in the normal season during November to May. With the introduction of new technologies on onion bulb production, off-season bulb production season during June to December through sets and by seedlings has become possible. This has lead to increase in demand of onion seeds. The seed demand of main and off-season onion varieties is partly fulfilled by domestic production and partly by import from India.

Some nutrient management studies were done in past to understand the role of different plant nutrients on onion seed production. Ali *et al*. (2007) reported that nitrogen (N) enhances the vegetative growth and accelerates carbohydrate synthesis and earlier crop growth and promotes bolting process and seed maturation ultimately. Phosphorus (P) is directly involved phonological growth of plant while potash (K) is necessary for photosynthesis activity of leaf to assist in food translocation. Furthermore, K enhances root growth, increased assimilation of food and grain formation. The study on various levels of nitrogen, phosphorus and potassium on yield and seed production of Metthiola incana revealed that plants with high ratio of nitrogen and phosphorus to potassium showed potassium deficiency at the flowering

[1] Technical Officer, Regional Agricultural Research Station, Lumle. E-mail: dev.tiwari17@gmail.com

time and highest number of seeds was obtained from the high potassium levels and low nitrogen and phosphorus levels. It also was understood that high nitrogen resulted into reduced seed production (Semeniuk, 1964). The beneficial effect of nitrogen in increasing seed yield of onion has been illustrated by Nourai *et al*. (2003). In similar study in Rajmash (Phaseolus vulgaris) higher grain yield (1375kgha^{-1}) was recorded with 120:75:60 kg N:P_2O_5:K_2Oha^{-1} fertilization, (Shubhashree *et al*., 2011).

Recently, Agri-Found Dark Red, a variety suitable for off-season onion bulb production has been identified. The popularity of onion bulb production during off-season (July - November) is increasing leading to higher seed demand. Despite high demand seed productivity of Agri Found Dark Red (AFDR) variety has been achieved only 43.0kg/500 m^2 in Deurali, Palpa (RARS Lumle, 2008). However, there is possibility of seed productivity enhancement through proper nutrient management (SIMI, Nepal, 2007). Therefore, this study was conducted to explore appropriate combination of plant nutrients for better seed yield of AFDR onion variety.

MATERIALS AND METHOD

The plant nutrient management trial was conducted on onion seed production of Agri Found Dark Red variety using bulbs produced during August - December (off-season) in two consecutive years: 2008 and 2009 in mid hill agro-climatic region of Deurali, Palpa. Randomized complete block design was employed with three replications with seven treatments. The treatments used in the experiment were 20, 40, 60, and 80kg K_2Oha^{-1}, 40kg K_2Oha^{-1} + Multiplex once, 40kg K_2Oha^{-1} + Multiplex twice and FYM 20tha^{-1} (Control). The FYM 20tha^{-1} and N and P_2O_5 at the rate of 60kgha^{-1} were kept constant for all the treatments except for control. The full dose of FYM and P_2O_5 also half of N were applied as basal dose during the time of land preparation before planting of bulbs. The remaining half dose of N was applied after one month of planting. The Multiplex, a kind of liquid fertilizer supplying multiple micronutrient was first applied at 45 days after planting and second application was used at 70 days after planting (DAP) as foliar spray at rate of 2.5ml per litre of water wetting whole plant. The spraying was carried out in 4-5 pm to minimize risk to pollinating insects including bees. The plot size was maintained 5.04 m2 with spacing of 40cm x 30cm adjusting 42 plants. The bulbs were produced during July-December (Off-season). The green tops of harvested bulbs were removed at least above 5cm and roots were trimmed. Over and undersized, abnormal bulbs with swollen neck were removed. Those selected bulbs were cured for about two to three weeks. The transplanting of bulbs was carried out during the first week of January and harvesting of seeds was done at the end of May. Observations were recorded on days to 50% bolting and days to flowering after transplanting, number of harvested plants and seed yield. General analysis of variance was done by Genstat 12th edition software.

RESULTS AND DISCUSSION

Days to 50% bolting

The statistical analysis showed highly significant difference in days to 50% bolting for treatment and year (Table 1). Earliest bolting (40.2 days after planting) was observed in the plants fertilized with 60kg K_2Oha^{-1} followed by 20kg K_2Oha^{-1} (40.7 days). Ali *et al*. (2007) reported earlier scaping at 38 days from 100kg Nha^{-1} and 120kg K_2Oha^{-1} which is higher dose than used in this study. Furthermore, they did not obtain significant variation among different potassium doses which is also consistent

with this study because within the potassium doses no significant difference was observed. It could be due to balanced combination and optimum level of N, P_2O_5 K_2O required for phonological growth. Delayed bolting (45 days) was obtained in the plants applied only FYM @ 20tha^{-1} (control). Early bolting was found in 2009 which could be due to high temperature accelerated by prolonged drought conditions.

Days to 50% flowering

The Days to 50%-flowering was significant for treatment (Table 1). Earlier flowering (77 days) was noted in the plants where 60kg K_2Oha^{-1} was applied followed by 78 days from application of 40kg K_2Oha^{-1}. It is likely that proper dose of potassium could have enhanced the reproductive phase. Longest time (80.2 days) was taken by control treatment which was similar to 80kg K_2Oha^{-1} and 40 kgK_2Oha^{-1} supplimented with one or two sprays of micronutrient multiplex . Delayed flowering with additional potassium level and multiplex might be caused by extended vegetative period.

Table 1: Effect of plant nutrients on days to 50% bolting and flowering in onion seed production.

Treatments	Days to 50% bolting			Days to 50% flowering		
	2008	2009	Mean	2008	2009	Mean
T_1. 20kg K_2Oha^{-1}	45.7	35.7	40.7	91.0	65.0	78.0
T_2. 40kg K_2Oha^{-1}	48.0	36.0	42.0	92.3	65.7	79.0
T_3. 60kg K_2Oha^{-1}	43.7	36.7	40.2	88.7	65.3	77.0
T_4. 80kg K_2Oha^{-1}	48.7	37.0	42.8	92.7	66.3	79.5
T_5. 40kg K_2Oha^{-1} + Multiplex one spray	49.7	37.3	43.5	92.3	66.0	79.2
T_6. 40kg K_2Oha^{-1} + Multiplex two spray	50.0	38.3	44.2	92.0	67.0	79.5
T_7. FYM 20tha^{-1} (Control)	50.0	40.0	45.0	90.7	69.7	80.2
Grand mean	47.9	37.3	42.6	91.4	66.4	78.9
CV%	2.9			2.6		
	F-test	$LSD_{(0.05)}$		F-test	$LSD_{(0.05)}$	
Treatment	*	1.44		*	2.39	
Year	**	0.77		**	1.28	
Treatment*year	ns	2.04		ns	3.38	

*Note: ns= not significant; *= significant at 5%; **= highly significant at 1% level.*

Number of harvested plants

The result showed that year effect was highly significant for number of harvested plants however treatment and treatment by year interaction was insignificant (Table 2). The significant year effect could be due to prolonged drought condition during the second year of study in that location. It resulted into the earlier bolting and flowering consequently decreased seed yield in the second year.

Seed yield

The seed yield was highly significant due to treatments, year and their interactions (Table 2). The result showed that highest seed yield of 813kgha^{-1} was obtained from application of 40kg K_2Oha^{-1} + multiplex twice followed by 60kg K_2Oha-1 (741 kg ha^{-1}). Lowest seed yield of 476kgha^{-1} was produced in control (FYM 20tha^{-1}). The findings indicated that application of 40kg K_2Oha^{-1} supplemented with two sprays of multiplex plus 60:60kg N and P_2O_5ha^{-1} and 20tha^{-1} compost produces higher seed productivity in onion. The result obtained from the study was contradicting with the findings of Ali *et al*. (2007) where they observed increased seed yield of onion with higher doses of potash ranging from 80 to 120kgha^{-1}. Shubhashree *et al*. (2011) reported significantly higher grain yield with 60kg K_2Oha^{-1} fertilization in okra is consistent in onion seed production in this study.

Table 2: Effect of plant nutrients on number of harvested plants and seed-yield in onion seed production

Treatments	Harvested plants			Seed yield kg ha^{-1}		
	2008	2009	Mean	2008	2009	Mean
T_1. 20 kg K_2O ha^{-1}	34.0	42.0	38.0	522	516	519
T_2. 40 kg K_2O ha^{-1}	33.7	42.0	37.8	608	549	579
T_3. 60 kg K_2O ha^{-1}	33.7	41.3	37.5	913	569	741
T_4. 80 kg K_2O ha^{-1}	30.0	39.7	34.8	780	608	694
T_5. 40 kg K_2O ha^{-1} + Multiplex once	29.7	38.7	34.2	767	635	701
T_6. 40 kg K_2O ha^{-1} + Multiplex twice	34.0	38.3	36.2	939	688	813
T_7. FYM 20 t ha^{-1} (Control)	34.0	38.3	36.2	463	489	476
Grand mean	32.7	40.1	36.4	713	579	646.0
CV%	10.4			13.8		
	F-test	$LSD_{(0.05)}$		F-test	$LSD_{(0.05)}$	
Treatment	ns	4.5		**	0.11	
Year	**	2.4		**	0.1	
Treatment*year	*	6.3		*	0.15	

*Note: ns= not significant; *= significant at 5%; **= highly significant at 1% level.*

CONCLUSION

Days to bolting and flowering was observed earlier when 60kg K_2Oha^{-1} and FYM 20tha^{-1}+ 60:60kg N, $P_2O_5ha^{-1}$ was applied. However, the bolting and flowering behaviour of onion did not showed similar pattern with variation in potassium levels. Increase in seed yield was not consistent with increased potassium levels. Highest seed yield (813$kgha^{-1}$) was obtained from the treatment where 40kg K_2Oha^{-1} + double dose of Multiplex were applied. It was obvious that application of micronutrient multiplex is beneficial for better harvest of seed. Hence combination of micronutrient spraying with 40kg K_2Oha^{-1} followed by 60:60:60kg N, P_2O_5, K_2Oha^{-1} were proved to be effective and could be recommended to the uptake pathway from the viewpoint of seed yield and earlier bolting as well as flowering respectively.

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