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Research Article

EFFECT OF ORGANIC MANURES ON THE YIELD AND QUALITY OF TRUE SEEDS OF ONION

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Abstract

The present study was stimulated by the problem of onion seed production where seed production is possibly only winter period after which rapid increase in temperature as well as early shower adversely affect the quality of seed. The experiment waslaid out in a randomized complete block design with four replicationsto determine optimum doses of manures and fertilizers for maximizing quality true seeds of onion. Six treatmentsviz. T_1= Only inorganic fertilizer recommended by Spices Research Centre (SRC),T_2= T_1 + Cowdung manure7.5 t/ha, T_3= T_1 + Poultry manure 5 t/ha, T_4= T_1 + Mustard oil cake 5 t/ha,T_5= T_1 + Dhaincha 5 t/haand T_6= Control (No manures and fertilizer application)were consisted to achieve the objective. The research work was done at On-Farm Research Division, BARI, Bogra during September, 2010 to June, 2011. The results revealed that the growth parameters, seed yield components, health and quality of harvested seeds were significantly influenced by the different treatments. Results showed that among different treatments, inorganic fertilizer Urea, TSP, MoP, Gypsum, Zinc oxide and Boric acid @ 250, 275, 150, 110, 3 and 5 kg/ha, respectively along with Cowdung 7.5 t/hawas the best for true seed production of onion at Bogra region in Bangladesh.

Key word: Organic manure, fertilizer, yield, quality, true seeds, onion

Introduction

Onion (*Allium cepa* L.) is one of the most important spice crops in Bangladesh. It was introduced into the Asian sub-continent from Palestine (MacGillivary, 1961). Onion has great economic importance due to its medicinal and dietetic values. It is widely used as condiment, salad and dressing of food. The average consumption of onion in Bangladesh is 25 g/head/day (BBS, 2010). It is grown in almost all the districts of Bangladesh; its commercial cultivation is concentrated in Faridpur, Dhaka, Rajshahi, Comilla, Mymensingh, Jessore, Rangpur and Pabna (BBS, 2010). Onion is grown in about 318,000 acres of land. The annual production is 894,000 tons of onion bulbs (BBS, 2010).

Onion is a biennial crop. It completes vegetative phase with bulb production in the first year. The bulbs are used as planting material for production of true seed in the second year. The demands of quality true seeds are increasing day by day. The price of true seeds is also high. The seeds available in the market are poor in quality. The total production of onion seed in Bangladesh is about 150 tons/year but the requirement is more than 900 tons (BBS, 2009). Climatic condition of Bangladesh is not suitable for the production of true seed by seeds to seed method (Rashid, 1976). The yield of true seeds of onion is low. There are many constraints for low yield of true seeds of the crop. Among them, deficiency of soil nutrients,lack of quality seeds and diseases are the major problems of onion seed production. The low organic matter content, higher cropping intensity, improper cropping sequence and faulty management practices are the major causes of depletion of soil fertility. The productivity, particularly the yield per unit area of a wide range of crops in Bangladesh is in a state of stagnating condition due to (1) little or no addition of organic matter to the soil, (2) Intensive cropping throughout the year, (3) Nutrient depletion, (4) Imbalanced fertilization and (5) poor management practices in crop production (Miah, 1994). It is true that sustainable production of crops cannot be maintained by using only chemical fertilizers and similarly, it was not possible to obtain higher crop yield by using organic manure alone (Bair, 1990). Sustainable crop production could be possible through the integrated use of organic manure and chemical fertilizers.A suitable combination of organic and inorganic sources of nutrients is necessary for a sustainable agriculture that will provide good quality true seeds of onion. Integrated use of organic

manures and chemical fertilizers would be quite promising not only in providing greater stability in production, but also in maintaining higher soil fertility status (Nambiar *et al.*,1998).Keeping all these above facts in view, the present study was undertaken to determine the optimum doses of manures and fertilizers for maximizing quality true seeds of onion.

Materials and Methods

The experiment was carried out at On-Farm Research Division, Bangladesh Agricultural Research Institute (BARI), Bogra during the period of September, 2010 to June 2011.The experimental field was opened with a power tiller and thoroughly prepared by ploughing and cross ploughing followed by laddering. The subsequent operations were done with harrow, spade, hammer etc. The weeds and stubbles were collected and removed from the field. The surface was leveled with a harrower (ladder) driven by a power tiller. Irrigation and drainage channels were made around the plots. The corners of the plots were trimmed by the spade. The field experiment was laid out in a Randomized Complete Block Design with four replications. The field was divided into four blocks after final land preparation. Each block was divided into six experimental units. The treatments were assigned in each block at random. The size of each unit plot was 1m × 3m. Block to block and plot to plot distance were 100 cm and 50 cm, respectively. Row to row and bulb to bulb were 25 cm and 20 cm, respectively. Each plot had four rows. Fifteen seed bulbs were sown in each row. Before conducting the experiment soil samples were collected from experiment field and then sent to the SRDI laboratory, Bogra for chemical analysis. The chemical properties of the soil are presented in Table 1.The experiment was consisted with six treatments such as T_1= Only inorganic fertilizer recommended by SRC (Urea, TSP, MoP, Gypsum, Zinc oxide and Boric acid @ 250, 275, 150, 110, 3 and 5 kg/ha, respectively (Anonymous,2010), T_2= T_1 + Cowdung manure7.5 t/ha,T_3= T_1 + Poultry manure 5 t/ha, T_4= T_1 + Mustard oil cake 5 t/ha, T_5= T_1 + Dhaincha 5 t/ha andT_6= Control (No manures and fertilizers application). BARI Piaj-1 variety was used in the research program. The entire amount of Cowdung, Poultry manure, Mustard oil cake, Dhaincha, TSP, Gypsum, Zinc oxide, Boric acid, one third of Urea and one third of MoP were applied at the time of final land preparation. Rest of urea and MoP were applied in three equal installments at 30, 50 and 70 DAP. Water was sprinkled with a watering can after emergences of the shoots at 10 DAP. Afterword each plot was irrigated at 30, 50, 70 and 105 DAP to keep the field soil nearly at field capacity. Excess water was drained out properly as and when necessary. First weeding was done by hand picking just after 15 days of shoot emergence. The second weeding was done by "Khurpi" (hand weeder) at 35 DAP. Rovral (50 WP) @ 2g/l of water were sprayed at 15 days interval starting from 30 DAP upto 120 DAPto control purple blotchandAdmire were applied @ 0.5 ml/l of water at 105 and 120 DAP to control thrips. The crop was harvested 145 to 150 days. When the seeds inside the capsules become black and 25-30% black seeds were exposed on the umbel, then each umbel was cut with 5-7 cm flower stalk. Harvesting was continued for 3-7 days. The umbels were sun dried. Threshing was done by light beating and hand rubbing of the umbels. The seeds were cleaned and sun dried for 3-4 days until seed moisture reduced to below 8%. The seeds of individual plots were processed separately and contained in a separate brown paper bag and preserved for further use. Data on different growth parameters (Plant height,number of leaves/plant, Leaf area index, length and diameter of the pseudo-stem), yield parameters (Number of stalk/plant, number of umbel/plant, umbel diameter, number of flowers/umbel, number of seeds/umbel, 1000 seed weight, seed weight/plant, seed weight/plot), seed health (% moisture, % germination, % seed borne fungi) were recorded and analyzed statistically following Duncans Multiple Range Rest (DMRT). Thebenefit cost ratiowas calculated from the cultivated plant.

Results and Discussion

The effect of organic manures on the growth parameters are presented in Table 2. The emergence was 94.58%, 97.50%, 94.58%, 93.33% and 92.50% in T_1, T_2, T_3, T_4 and T_5, respectively. Emergence was 87.92% inT_6. Plant height was significantly influenced by the different treatments. The highest plant height (47.47 cm) was recorded in T_2. The lowest plant height (30.45 cm) was observed in T_6. The number of leaves/plant was 14.41 in T_2. The lowest number of leaves/plant was in T_6. The number of leaves/plant was identical in T_1, T_4 and T_5. Leaf area index was significantly different among the treatments. The leaf area index was 3.56 in T_2. It was statistically similar in T_1, T_3, T_4 and T_5. The lowest leaf area index (0.40) was recorded in T_6. The higher length of the pseudo-stem (7.35 cm) was recorded in T_2. The lowest length of the pseudo-stem (4.00cm)was observed in T_6. The diameter of the pseudo-stem significantly differed among the treatments. The diameter of the pseudo-stem was 3.22 cm in T_2. It was identical in T_1, T_3, T_4 and T_5. The lowest diameter of the pseudo-stem (1.93 cm) was recorded in T_6.

The effect of organic manures on the seed yield parameters of true seeds of BARI Piaj-1 are presented in Table 3. The number of stalk/plant was significantly influenced by the treatments. The number of stalk/plant was 4.34 in T2. It was identical in T1, T3, T4 and T5 treatment. The number of stalk/plant was 1.88 in T6. The umbel and flower characteristics of onion were significantly influenced by the application of different organic manures and fertilizers (Table 3 and Plate 1). The number of umbel/plant was 4.66 recorded in T2. It was statistically similar in T1, T3, T4 and T5. The number of umbel was 2.04 in T6. The umbel diameter varied among the treatments. The umbel diameter

was 6.89 cm in T2. It was statistically similar in T3, T4 and T5 but significantly different between T1 and T6.The umbel diameter was 3.66 cm in T6. The number of flowers in T2 was 481.40. It was identical in T1, T3, T4 and T5. The number of flowers/umbel was 183.95 in T6. The number of seeds/umbel was significantly influenced by the treatments. The number of seeds/umbel was 269.58 in T2. There was no variation in number of seeds/umbel between T1, T3, T4 and T5. The number of seeds/umbel was 99.33 in T6. Thousand seed weight and seed weight/plant were influenced by different treatments. The 1000-seed weight was 4.09 g in T2. It was significantly different from T1 and T6. The 1000-seed weight was 1.46 g in T6. The seed weight/plant was 5.20 g in T2. The seed weight/plant was low 0.64 g in T6. The seed weight/plot (304.3 g) was recorded in T2. It was significantly different from T6 and T5. The lowest seed weight/plot was 33.25 g in T6. There was no statistically variation among T1, T2, T3 and T4 (Table 3).

Table 1: The chemical properties of soil in the experimental field

Soil pH	Organic Carbon (%)	Total nitrogen (%)	Available phosphorus(ppm)	Exchangeable potassium (meq/100g soil)	Available sulphur (ppm)	Available zinc (ppm)	Available boron (ppm)
5.65	0.65	0.065	7.15	0.075	6.48	1.31	0.123
Soil status	Very low	Very low	Very low	Very low	Very low	medium	Very low
Critical limit	1.01	0.12	7.0	0.12	10.0	0.6	0.2

Table 2: Effect of organic manures on the growth parameters of BARI Piaj-1

Treatment	Bulb emergence/plot		Plant height (cm)	No. of leaves/ plant		Leaf area index (LAI)	Pseudo-stem	
	Number	(%)					Length (cm)	Diameter (cm)
T_1	56.75 a	94.58 a	42.00 b	12.16 b		2.76 a	6.69 a	3.19 a
T_2	58.50 a	97.50 a	47.47 a	14.41 a		3.56 a	7.35 a	3.22 a
T_3	56.75 a	94.58 a	42.53 b	13.35 ab		2.95 a	6.88 a	2.86 a
T_4	56.00 ab	93.33 ab	42.63 b	12.36 b		2.82 a	7.33 a	3.01 a
T_5	55.50 ab	92.50 ab	42.75 b	12.59 b		2.71 a	7.15 a	2.94 a
T_6	52.75 b	87.92 b	30.45 c	9.85 c		0.40 b	4.00 b	1.93 b
LSD $_{(0.05)}$	3.33	5.55	2.66	1.31		1.08	1.29	0.36
CV (%)	5.94	9.90	6.09	5.03		9.40	9.45	6.02

[Means followed by the same letter in a column did not differ significantly at the 5% level by DMRT. LAI=Leaf area index T_1= Only inorganic fertilizers recommended by SRC (Urea, TSP, MoP, Gypsum, Zinc oxide and Boric acid @ 250-275-150-110-3 and 5 kg/ha, respectively), T_2= T_1+ Cowdung 7.5 t/ha, T_3= T_1+ Poultry manure 5 t/ha,T_4= T_1+ Mustard oil cake 5 t/ha, T_5= T_1+ Dhaincha 5 t/ha and T_6= Control (No manures and fertilizers)]

Table 3: Effect of organic manures on the seed yield parameters of onion

Treatment	No. of stalk/plant	No. of umbel/ plant	Umbel diameter (cm)	No. of flowers/ umbel	No. of seeds/ umbel	1000-seed weight (g)	Seed weight/plant (g)	Seed weight/ plot (g)
T_1	4.14 a	3.64 a	5.58 b	447.90 a	246.35 a	3.56 b	4.18a	237.80 ab
T_2	4.34 a	4.66 a	6.89 a	481.40 a	269.58 a	4.09 a	5.20a	304.30 a
T_3	4.14 a	4.15 a	6.56 ab	467.20 a	256.96 a	3.92 ab	4.41a	252.50 ab
T_4	3.53 ab	4.24 a	6.48 ab	462.00 a	254.10 a	3.86 ab	4.29a	241.00 ab
T_5	3.84 a	4.21 a	6.05 ab	458.00 a	251.90 a	3.82 ab	4.11a	226.80 b
T_6	1.88 b	2.04 b	3.66 c	183.95 b	99.33 b	1.46 c	0.64b	33.25 c
LSD $_{(0.05)}$	1.77	1.49	1.12	30.95	12.95	0.40	1.23	66.92
CV (%)	8.28	9.92	7.94	7.75	7.52	5.51	6.56	6.88

[Means followed by the same letter in a column did not differ significantly at the 5% level by DMRT. T_1= Only inorganic fertilizers recommended by SRC (Urea, TSP, MoP, Gypsum, Zinc oxide and Boric acid @ 250-275-150-110-3 and 5 kg/ha, respectively), T_2= T_1+ Cowdung 7.5 t/ha, T_3= T_1+ Poultry manure 5 t/ha,T_4= T_1+ Mustard oil cake 5 t/ha, T_5= T_1+ Dhaincha 5 t/ha and T_6= Control (No manures and fertilizers application).]

T_1= Only inorganic fertilizers recommended by SRC

T_2= T_1+ Cowdung 7.5 t/ha

T_3= T_1+Poultry manure 5 t/ha

T_4= T_1+Mustard oil cake 5 t/ha

T_5= T_1+Dhaincha 5 t/ha

T_6= Control (No manures and fertilizer)

Plate 1: Photograph showing the umbel and flower characteristics of BARI Piaj-1 as influenced by the application of different organic manures.

Table 4: Effect of organic manures on seed health and quality of onion

Treatment	Moisture (%)	Germination (%)	Seed borne fungi (%)
T_1	7.35	80 a	4.75 b
T_2	7.33	83 a	4.25 b
T_3	7.40	80 a	4.25 b
T_4	7.35	81 a	5.25 a
T_5	7.38	80 a	4.25 b
T_6	7.40	40 b	12.25 a
LSD $_{(0.05)}$	NS	5.00	2.38
CV (%)	5.69	5.25	5.55

The effect of organic manures on moisture content, germination and incidence of seed borne pathogen of onion seed are presented in Table 4. The percentage of moisture content did not differ significantly among the treatments. But the germination was significantly influenced by the treatments. The germination was 83 % in T_2,81% in T_4, 80% in T_1, T_3 and T_5. The lowest germination (40 %) was obtained from T_6. The incidence of seed borne pathogen significantly differed among the treatments. The lower incidence of *Alternaria porri* was 4.25 % in T_2, T_3 and T_5. The higher incidence of seed borne infection was 12.25% in T_6.

Means followed by the same letter in a column did not differ significantly at the 5% level by DMRT. T_1= Only inorganic fertilizers recommended by SRC (Urea, TSP, MoP, Gypsum, Zinc oxide and Boric acid @ 250-275-150-110-3 and 5 kg/ha, respectively), T_2= T_1+ Cowdung 7.5 t/ha, T_3= T_1+ Poultry manure 5 t/ha,T_4= T_1+ Mustard oil cake 5 t/ha, T_5= T_1+ Dhaincha 5 t/ha and T_6= Control (No manures and fertilizers application) NS= Not significant.Benefit-cost analysis of organic manures and fertilizers on the seed yield of onion (BARIPiaj-1) are presented in Table 5. The highest gross return (Tk.1044330/ha), net return (Tk.773652/ha) and benefit cost ratio (3.86) was recorded in T_2. The lowest gross return (Tk.11o830/ha), no net return and no benefit was observed in T_6.

Seed yield was 1044.33 kg/ha, germination was 83% and economic return was high when inorganic fertilizers were applied along with cowdung 7.5 t/ha. Sindhu and Tiwari (1993) opined that the growth, yield and quality of onion seeds were markedly influenced by the application of proper dose of organic and inorganic nutrients. Singh *et al*. (1989) noted that 120 kg N (*Sesbania aculata*) and 50 kg K_2O gave the highest bulb yield. Rashid (2003) harvested 960.75 kg/ha of seeds from BARI Piaj-1 when cowdung was applied at 10 t/ha along with inorganic fertilizers.

Table 5: BCR of organic manures on the seed yield of onion

Treatment	Seed yield (kg/ha)	Gross return (Tk./ha)	Total cultivation cost (Tk./ha)	Net return (Tk./ha)	Benefit cost ratio
T_1	792.67	792670	251928	540742	3.15
T_2	1044.33	1044330	270678	773652	3.86
T_3	841.67	841670	264428	577242	3.18
T_4	809.33	809330	376928	432402	2.15
T_5	800.60	800600	264428	536172	3.03
T_6	110.83	110830	232238	-	-

Urea= Tk.20/kg
TSP= Tk.22/kg
MoP=Tk.15/kg
Gypsum=Tk.8/kg
Zinc oxide=Tk.120/kg
Boric acid=Tk.250/kg
Cowdung=Tk.2.5/kg
Poultry manure=Tk.2.5/kg
Onion seed= Tk.1000/kg
Mustard oil cake= Tk.25/kg
Dhaincha= Tk.2.5/kg
Rovral= Tk.2200/kg
Admire= Tk.6800/l
Labour= Tk.200/Man/day
Irrigation= Tk.2250/ha/irrigation
Seed bulb= Tk.45/kg
Lease value of land= Tk.22500/ha for 5 months

Conclusion

Based on the results of the experiment, inorganic fertilizer Urea, TSP, MoP, Gypsum, Zinc oxide and Boric acid @ 250, 275, 150, 110, 3 and 5 kg/ha, respectively along with Cowdung 7.5 t/ha recommended for true seed production of onion at Bogra region in Bangladesh. Miah M M U (1994) Prospects and problems of organic farming in Bangladesh. Paper presented at the Workshop on Integrated Nutrient Management for Sustainable Agriculture held at SRDI, Dhaka, June-26-28, 1994

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