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INTEGRATED CROP MANAGEMENT FOR PRODUCTION OF TRUE SEEDS OF ONION

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ABSTRACT

Onion is a biennial crop. True seed is used for bulb production in the first year, and these bulbs are used as planting material in the second year for true seed production. The present study was under taken on 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 was laid out in a randomized complete block design with four replications to determine the effect of frequency of application of pesticides and optimum doses of manures & fertilizers for maximizing quality true seeds of onion. Five treatments viz. T_1= Spices Research Centre (SRC) recommended dose of fertilizer + Rovral spray at 15 days interval upto maturity stage + no spray of Admire T_2= Modified dose of fertilizer + Rovral spray at 15 days interval upto maturity stage + no spray of Admire T_3= No manures & fertilizer application + Rovral spray at 15 days interval upto maturity stage + no spray of Admire T_4= SRC recommended dose of fertilizer + No spray of Rovral and Admire T_5= Modified dose of fertilizer + 3 sprays of Rovral at vegetative, umbel formation (70%) and flowering (70%) stage) + 1 spray of Admire at flowering stage were consisted to achieve the objective. The research work was done at On-Farm Research Division, BARI, Bogra during September, 2011 to June, 2012. 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, 3 sprays of Rovral at vegetative, umbel formation and flowering stage at 2 g/l of water along with one spray of Admire (Imidacloprid) at flowering stage at 0.5 ml/l of water was the best combination for true seed production of onion. Integrated crop management revealed that the application of 150, 275, 150, 110, 3 and 5 kg/ha of Urea, TSP, MoP, Gypsum, Zinc oxide and Boric acid, respectively, along with Cowdung 5 t/ha was required for quality seed production of onion at Bogra region in Bangladesh.

KEYWORD: Integrated crop management, 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 128745 ha of land. The annual production is 894,000 tons of onion bulbs (BBS, 2010).

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). Breaking of floral stalk due to injuries caused by *Alternaria Porri* is a limiting factor for production of true seeds of onion. Munoz *et al*. (1985) reported that different seed borne pathogens are associated with onion seeds such as *Aspergillus niger*, *A. flavus*, *Fusarium moniliforme*, *Rhizopus stolonifer* and *Stemphylium botryosum*. The major diseases of onion are purple blotch (*Alternaria porri*), seed rot (*Alternaria* sp. and *Fusarium* sp.), germination failure (*Aspergillus* f*lavus*, *A. glaucus*, *Rhizopus* sp. and *Fusarium* sp.), black mould (*Aspergillus niger*), and white rot (*Sclerotium cepivorum*) (Fakir 2001). Keeping all these above facts in view, the present study was undertaken to the effect of frequency of application of pesticides and to determine the optimum doses of manures & 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, 2011 to June 2012. 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 five 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 experimental field and then sent to the SRDI (Soil Resourses Development Institute) laboratory, Bogra for chemical analysis. The chemical properties of the soil are presented in Table 1. The experiment was consisted with five treatments such as T_1= Spices Research Centre (SRC) recommended dose of

fertilizer + Rovral spray at 15 days interval upto maturity stage + no spray of Admire T_2= Modified dose of fertilizer + Rovral spray at 15 days interval upto maturity stage + no spray of Admire T_3= No manures & fertilizer application + Rovral spray at 15 days interval upto maturity stage + no spray of Admire T_4= SRC recommended dose of fertilizer + No spray of Rovral and Admire T_5= Modified dose of fertilizer + 3 spray of Rovral (vegetative, umbel formation (70%) and flowering (70%) stage) + 1 spray of Admire at flowering stage. Recommended dose such as 1000, 250, 275, 150, 110, 3, 5 kg/ha of Cowdung, Urea, TSP, MoP, Gypsum, Zinc oxide, Boric acid (Anonymous, 2010) and modified dose 5000, 150, 275, 150, 110, 3, 5 kg/ha of Cowdung, Urea, TSP, MoP, Gypsum, Zinc oxide, Boric acid, respectively. The entire amount of Cowdung, 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. BARI Piaj-1 variety was used in the research program. 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 to control purple blotch and Admire were applied @ 0.5 ml/l of 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). The benefit cost ratio was calculated from the cultivated plant.

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
-	-	Very low	Very low	Very low	Very low	medium	Very low

RESULTS AND DISCUSSION

The effect of integrated crop management on bulb emergence/plot, plant height, number of leaves/plant, leaf area index, length and diameter of the pseudo-stem of onion are presented in Table 3. The emergence of the bulbs was similar in all treatment. The plant height was 52.97 cm in T_1, 52.84 cm in T_5, 51.29 cm in T_4. The lowest plant height (39.59 cm) was recorded in T_3. The number of leaves/plant was 14.41 in T_1. It was statistically identical in T_5 (16.05), T_4 (15.86) and T_2 (14.89).

The number of leaves/plant was 9.94 in T_3. The leaf area index was 3.96 in T_1, 3.65 in T_5 and 3.16 in T_2. Leaf area index was 0.58 in T_3. The length of the pseudo-stem was 8.24 cm in T_1. It was similar (8.18 cm) inT_5 and 8.00 cm in T_4. Length of pseudo-stem was 4.13 cm in T_3. Diameter of the pseudo-stem was 4.88 cm in T_1. The diameter of the pseudo-stem was 1.90 cm in T_3.

Table 2: Effect of integrated crop management on the growth parameters of onion.

Treatment	Bulb emergence/plot	Plant height (cm)	No. of leaves/ plant	Leaf area index	Pseudo-stem	
					Length (cm)	Diameter (cm)
T_1	60.00	52.97 a	16.20 a	3.96 a	8.24 a	4.88 a
T_2	60.00	49.33 b	14.89 a	3.16 ab	7.30 b	3.88 b
T_3	60.00	39.59 c	9.94 b	0.58 c	4.13 c	1.90 c
T_4	59.50	51.29 ab	15.86 a	3.02 b	8.00 a	4.53 a
T_5	60.00	52.84 a	16.05 a	3.65 ab	8.18 a	4.80 a
LSD $_{(0.05)}$	NS	3.35	2.42	0.83	0.57	0.59
CV (%)	5.19	4.42	10.78	9.80	5.18	9.53

Means followed by the same letter in a column did not differ significantly at the 5% level by DMRT. NS=Not significant. T_1= SRC recommended dose of fertilizer + Rovral spray at 15 days interval upto maturity stage + no spray of Admire, T_2= Modified dose of fertilizer + Rovral spray at 15 days interval upto maturity stage + no spray of Admire, T_3= No manures & fertilizer application + Rovral spray at 15 days interval upto maturity stage + no spray of Admire, T_4= SRC recommended dose of fertilizer + No spray of Rovral and Admire and T_5=

Modified dose of fertilizer + 3 spray of Rovral at vegetative, umbel formation (70%) and flowering (70%) stage + 1 spray of Admire at flowering stage.

The effect of integrated crop management on the seed yield parameters of BARI Piaj-1 are presented in Table 3. Number of stalk/plant was 4.58 in T_1, 4.55 in T_2, 4.46 in T_5 and 4.41 in T_4. Number of stalk/plant was 3.10 inT_3. Number of umbel/plant was 4.64 in T_1. It was identical with that of T_2, T_5 and T_4. The number of umbel/plant was low in T_3. The umbel diameter significantly influenced the treatments. The umbel diameter was 7.15 cm in T_1. Umbel diameter was 4.60 cm in T_3. Number of flowers/umbel was 512.50 in T_1, 493.00 in T_2 and 491.50 in T_5. The lowest number of flowers (250.40)/umbel was obtained fromT_3. The number of seeds/umbel was significantly influenced the treatments. Number of seeds/umbel was 280.10 in T_1. It was 275.80 in T_5 and 274.10 in T_2. The lowest number of seeds (85.94)/umbel was recorded in T_4. Thousand-seed-weight and seed weight/plant was influenced by different treatments. The higher 1000-seed weight (3.95 g) was recorded in T_1. It was similar in T_2 and T_5. The lowest 1000-seed weight was 1.20 g in T_4. The seed weight/plant was 5.09 g in T_1 which was statistically similar with 4.97 g in T_2 and 4.97 g in T_5. The lower seed weight/plant was 0.95 g in T_4. The seed weight/plot was 290.60 g in T_1. It was identical in T_2 and T_5. The lower seed weight/plot was 54.23 g in T_4. It was similar with T_3.

Table 3: Effect of integrated crop management 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	4.58 a	4.64 a	7.15 a	512.50 a	280.10 a	3.95 a	5.09 a	290.60 a
T_2	4.55 a	4.55 a	7.00 a	499.00 a	274.10 a	3.92 a	4.97 a	290.30 a
T_3	3.10 b	2.98 b	4.60 c	250.40 c	106.80 b	1.48 b	1.05 b	59.44 b
T_4	4.41 a	3.86 ab	5.95 b	426.50 b	85.94 c	1.20 c	0.95 b	54.23 b
T_5	4.46 a	4.48 a	6.90 a	491.50 a	275.80 a	3.91 a	4.97 a	289.70 a
$LSD_{(0.05)}$	1.06	0.88	0.40	22.31	7.27	0.08	0.18	5.63
CV (%)	11.23	10.92	6.16	7.32	8.31	5.02	6.47	5.88

Means followed by the same letter in a column did not differ significantly at the 5% level by DMRT. T_1= SRC recommended dose of fertilizer + Rovral spray at 15 days interval upto maturity stage + no spray of Admire, T_2= Modified dose of fertilizer + Rovral spray at 15 days interval upto maturity stage + no spray of Admire, T_3= No manures & fertilizer application + Rovral spray at 15 days interval upto maturity stage + no spray of Admire, T_4=

SRC recommended dose of fertilizer + No spray of Rovral and Admire, T_5= Modified dose of fertilizer + 3 spray of Rovral at vegetative, umbel formation (70%) and flowering (70%) stage + 1 spray of Admire at flowering stage.

Incidences of purple blotch of onion are presented in Table 4. The infected plant/plot was similar in all plots at 30 days after planting (DAP). But the number of infected plant differed significantly at 60, 90 and 120 DAP. The infected plant decreased with increase in planting period of all the treatments except in T_4. Incidence was 5.00, 4.95 and 4.88% in T_1 at 60, 90 and 120 DAP, respectively. It was similar in T_2, T_3 and T_5 treatment. Incidence was 11.63, 15.38 17.63% in T_4 at 60, 90 and 120 DAP, respectively.

Table 4: Incidence of purple blotch of onion at different days after planting as affected by fertilizer application.

Treatment	Number of infected plant/plot (%)			
	30 DAP	60 DAP	90 DAP	120 DAP
T_1	6.75	5.00 c	4.95 b	4.88 b
T_2	6.75	5.88 bc	5.80 b	5.00 b
T_3	6.80	6.50 bc	6.00 b	5.25 b
T_4	6.78	11.63 a	15.38 a	17.63 a
T_5	7.77	7.25 bc	6.05 b	6.38 b
$LSD_{(0.05)}$	NS	2.99	2.37	1.91
CV (%)	10.05	9.37	9.46	7.93

Means followed by the same letter in a column did not differ significantly at the 5% level by DMRT. NS= Not significant. T_1= SRC recommended dose of fertilizer + Rovral spray at 15 days interval upto maturity stage + no spray of Admire, T_2= Modified dose of fertilizer + Rovral spray at 15 days interval upto maturity stage + no spray of Admire, T_3= No manures & fertilizer application + Rovral spray at 15 days interval upto maturity stage + no spray of Admire, T_4= SRC recommended dose of fertilizer + No spray of Rovral and Admire, T_5= Modified dose of fertilizer + 3 spray of Rovral at vegetative, umbel formation (70%) and flowering (70%) stage + 1 spray of Admire at flowering stage.

The number of purple blotch infected leaf/plot of onion at different days after planting are presented in Table 5. The infected leaf/plot was statistically identical in all plots at 30 DAP. Infected leaf/plot was 24.25, 32.50 and 37.85% in T_4 at 60, 90 and 120 DAP, respectively. Leaf infection was 12.75, 12.75 and 9.45% in T_1 at 60, 90 and 120 DAP, respectively. It was identical in T_2, T_3 and T_5.

Table 5: Number of infected leaf/plot of onion) at different days after planting

Treatment	Number of infected leaf/plot (%)			
	30 DAP	60 DAP	90 DAP	120 DAP
T_1	13.50	12.75 c	12.75 c	9.45 b
T_2	14.00	13.75 bc	14.00 c	9.65 b
T_3	16.00	15.50 b	15.75 b	9.75 b
T_4	14.25	24.25 a	32.50 a	37.85 a
T_5	14.50	15.00 bc	15.00 bc	9.80 b
LSD $_{(0.05)}$	NS	2.25	2.46	1.38
CV (%)	12.41	8.97	8.89	5.55

Means followed by the same letter in a column did not differ significantly at the 5% level by DMRT. NS= Not significant. T_1= SRC recommended dose of fertilizer + Rovral spray at 15 days interval upto maturity stage + no spray of Admire, T_2= Modified dose of fertilizer + Rovral spray at 15 days interval upto maturity stage + no spray of Admire, T_3= No manures & fertilizer application + Rovral spray at 15 days interval upto maturity stage + no spray of Admire, T_4= SRC recommended dose of fertilizer + No spray of Rovral and Admire, T_5= Modified dose of fertilizer + 3 spray of Rovral at vegetative, umbel formation (70%) and flowering (70%) stage + 1 spray of Admire at flowering stage.

Leaf area diseased (LAD) of onion at different days after planting are presented in Table 6. LAD did not differ significantly among the treatments at 30 DAP. But LAD was different at 60, 90 and 120 DAP, respectively. LAD was 7.40, 6.50 and 5.50% in T_1 at 60, 90 and 120 DAP, respectively. It was 7.44, 6.52 and 5.50% in T_5 at 60, 90 and 120 DAP, respectively. LAD was found to be identical in T_1, T_2, T_3 and T_5 at 60, 90 and 120 DAP, respectively. The higher LAD was 33.40, 40.35 and 45.75% in T_4 at 60, 90 and 120 DAP, respectively.

Table 6: leaf area diseased of onion at different days after planting

Treatment	Leaf area diseased of 50 leaf/plot (%)			
	30 DAP	60 DAP	90 DAP	120 DAP
T_1	8.53	7.40 b	6.50 b	5.50 b
T_2	8.79	7.63 b	6.65 b	5.65 b
T_3	8.80	7.88 b	6.80 b	6.15 b
T_4	8.82	33.40 a	40.35 a	45.75 a
T_5	8.43	7.44 b	6.52 b	5.50 b
LSD $_{(0.05)}$	NS	2.10	1.43	2.76
CV (%)	10.99	9.81	6.16	9.86

Means followed by the same letter in a column did not differ significantly at the 5% level by DMRT. NS= Not significant. T_1= SRC recommended dose of fertilizer + Rovral spray at 15 days interval upto maturity stage + no spray of Admire, T_2= Modified dose of fertilizer + Rovral spray at 15 days interval upto maturity stage + no spray of Admire, T_3= No manures

& fertilizer application + Rovral spray at 15 days interval upto maturity stage + no spray of Admire, T_4= SRC recommended dose of fertilizer + No spray of Rovral and Admire, T_5= Modified dose of fertilizer + 3 spray of Rovral at vegetative, umbel formation (70%) and flowering (70%) stage + 1 spray of Admire at flowering stage.

The numbers of infected stalk/plot of onion at different days after planting are presented in Table 7. There was no stalk infection in T_1, T_2, T_3 and T_5 at 60 DAP. Stalk infection was 2.50% in T_4 at 60 DAP. Stalk infection was 15.75 and 25.75% in T_4 at 90 and 120 DAP. Stalk infection was 3.75 and 2.75% in T_1 at 90 and 120 DAP, respectively.

Table 7: Number of infected stalk/plot of onion at different days after planting.

Treatment	Number of infected stalk/plot (%)		
	60 DAP	90 DAP	120 DAP
T_1	0.00 b	3.75 b	2.75 b
T_2	0.00 b	4.00 b	3.00 b
T_3	0.00 b	4.50 b	3.53 b
T_4	2.50 a	15.75 a	25.75 a
T_5	0.00 b	4.50 b	3.15 b
LSD $_{(0.05)}$	0.40	1.50	0.89
CV (%)	9.64	9.93	7.42

Means followed by the same letter in a column did not differ significantly at the 5% level by DMRT. T_1= SRC recommended dose of fertilizer + Rovral spray at 15 days interval upto maturity stage + no spray of Admire, T_2= Modified dose of fertilizer + Rovral spray at 15 days interval upto maturity stage + no spray of Admire, T_3= No manures & fertilizer application + Rovral spray at 15 days interval upto maturity stage + no spray of Admire, T_4= SRC recommended dose of fertilizer + No spray of Rovral and Admire, T_5= Modified dose of fertilizer + 3 spray of Rovral at vegetative, umbel formation (70%) and flowering (70%) stage + 1 spray of Admire at flowering stage.

The effect of integrated crop management on health and quality of true seeds of onion are presented in Table 8. The percentage of moisture content did not differ significantly among the treatments. But the germination percentage was significantly influenced by the different treatments. The maximum germination was 81% in T_1. It was 80% in T_2 and 79% in T_5. Seed germination was low (15%) in T_4. The incidence of seed borne pathogen significantly differed among the treatments. The highest seed borne fungi (*Alternaria porri*) was 23.75% in T_4. The lower seed borne fungi was 5.75% recorded in T_1 and T_2 followed by 6.25% in T_5.

Table 8. Effect of integrated crop management on health and quality of true seeds of onion.

Treatment	Moisture (%)	Germination (%)	Seed borne fungi (%)
T_1	7.54	81 a	5.75 c
T_2	7.54	80 a	5.75 c
T_3	7.54	17 b	9.75 b
T_4	7.55	15 b	23.75 a
T_5	7.55	79 a	6.25 c
LSD $_{(0.05)}$	NS	2.42	1.29
CV (%)	5.62	5.89	8.16

Means followed by the same letter in a column did not differ significantly at the 5% level by DMRT. NS= Not significant. T_1= SRC recommended dose of fertilizer + Rovral spray at 15 days interval upto maturity stage + no spray of Admire, T_2= Modified dose of fertilizer + Rovral spray at 15 days interval upto maturity stage + no spray of Admire, T_3= No manures & fertilizer application + Rovral spray at 15 days interval upto maturity stage + no spray of Admire, T_4= SRC recommended dose of fertilizer + No spray of Rovral and Admire, T_5= Modified dose of fertilizer + 3 spray of Rovral at vegetative, umbel formation (70%) and flowering (70%) stage + 1 spray of Admire at flowering stage.

The BCR of integrated crop management on the seed yield of onion are presented in Table 9. The higher gross return was Tk.988670/ha in T_1 followed by Tk.987670/ha in T_2. Net return was Tk.721542/ha and benefit cost ratio was 3.73 in T_5. It was Tk.718672/ha, benefit cost ratio was 3.67 in T_2. Net return (Tk.705142/ha) and benefit cost ratio (3.49) was recorded in T_1.The lower gross return was Tk.188770/ha in T_4 followed by Tk.198130/ha in T_3. There was no net return and no benefit cost ratio obtained from T_4 and T_3 treatment because total cultivation cost was higher than that of gross return.

Table 9: Benefit Cost Ratio (BCR) of integrated crop management 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	988.67	988670	283528	705142	3.49
T_2	987.67	987670	269028	718672	3.67
T_3	198.13	198130	238838	-	-
T_4	188.77	188770	249928	-	-
T_5	985.67	985670	264128	721542	3.73

Urea= Tk.20/kg Rovral= Tk.2200/kg

TSP= Tk.22/kg	Admire= Tk.6800/l
MoP=Tk.15/kg	Labour=Tk.200/man/day
Gypsum=Tk. 8/kg	Irrigation= Tk.2250/ha/irrigation
Zinc oxide=Tk.120/kg	Seed bulb= Tk.45/kg
Boric acid=Tk.250/kg	Lease value of land= Tk.22500/ha for 5 months
Cowdung=Tk.2.5/kg	Onion seed= Tk.1000/kg

Gupta *et al*. (1999) observed that the application of 5 t/ha of cowdung along with inorganic fertilizer produced the highest seed yield (982.75 kg/ha) and the lowest (572.82 kg/ha) from only inorganic fertilizers. Farid *et al*. (1998) showed that cowdung and poultry manure gave higher yield of onion seed when applied in combination with mineral and organic fertilizer. Rahman (2000) stated cowdung 10 t/ha and 3 sprays of Rovral @ 2 g/L of water reduced purple blotch and increased seed yield of onion. Kamal and Hossain (2011) advocated that application of Admire @ 0.5 ml/L of water at flowering stage showed satisfactory performance in controlling thrips.

CONCLUSION

Based on the results of the experiment, 3 sprays of Rovral at vegetative, umbel formation and flowering stage at 2 g/l of water along with one spray of Admire at flowering stage at 0.5 ml/l of water was the best combination for true seed production of onion. Integrated crop management revealed that the application of 150, 275, 150, 110, 3 and 5 kg/ha of Urea, TSP, MoP, Gypsum, Zinc oxide and Boric acid, respectively, along with Cowdung 5 t/ha was required for quality seed production of onion at Bogra region in Bangladesh.

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