PERFORMANCE OF DIFFERENT MANAGEMENT PRACTICES ON LENTIL IN DRYLAND AREAS

M.O.ALI[1], M.A.ISLAM[2], M.S.ALAM[3], M.J.ALAM[2] AND M.M.HOSSAIN[2]

[1]Principal Scientific Officer, [2]Scientific Officer, [3]Senior Scientific Officer, Pulses Research Centre, Ishurdi, Pabna, Bangladesh

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ABSTRACT

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A field experiment was conducted at Pulses Research Centre, Ishurdi, Pabna during rabi seasons of 2005-06 and 2006-2007 to find out the effect of different management practices on lentil cultivation for higher and economically viable yield. There were ten treatment combinations, such as control(T_1) , non-priming with recommended fertilizer dose (RFD) @ 20-40-20 kg/ha of N-P_2O_5-K_2O during final land preparation (T_2), seed priming over night with RFD (T_3), fertilizer application @ 20-60-20 Kg/ha of N-P_2O_5-K_2O (T_4), pre-sowing irrigation with RFD (T_5), RFD + post sowing irrigation (T_6), RFD + irrigation at 25 DAE (T_7), RFD + irrigation at 25 days after emergence (DAE) + urea top dressed @ 20 kg/ha of N (T_8), fertilizer P_2O_5 application @ 40 kg/ha within line (T_9) and seed priming overnight + broadcast with RFD (T_{10}) were included in the study. Among the ten treatments, T_8 produced the highest grain yield (2152 Kg/ha) in 2005-06. In 2006-07 the highest grain yield (2350 Kg/ha) was also obtained by T_8 which was identical to that of T_5, T_6 and T_7 but the lowest grain yield (1283 Kg/ha and 1522 Kg/ha) was obtained by control in 2005-06 and 2006-07, respectively. Through the combined analysis, pooled results showed that same treatments i.e. T_8 produced the highest grain yield (2251.0 Kg/ha) which was identical to T_7. From the economic analysis, it was observed that the highest net return (Tk 66804 and Tk 72950/ha) and the highest benefit cost ratio (4.47 and 4.46) were obtained by the treatment T_8 in 2005-06 and 2006-07, respectively.

Key word: Management practices, dry land, grain yield.

INTRODUCTION

Lentil (*Lens culinaris* Medik) is the early domesticated among crops. It plays an important role in human, animal and soil health improvement. It's seed is a rich source of protein, minerals (K,P, Fe, Zn) and vitamins for human nutrition (Bhatty 1988;Savage 1988), and the straw is a valued animal feed (Erskine *et al.1990*). Being legume, lentil is restorative in nature and its seed contains average 25.78% protein (Erskine and Witcombe, 1984) and 59% carbohydrate (Bakhsh *et al.*, 1991). Further more, because of its high lysine and tryptophan content, it's consumption with wheat or rice provides a balance in essential amino acids for human nutrition. Its cultivation improves soil nitrogen, carbon and organic matter status, thus providing sustainable crop production systems. In Bangladesh, among pulses lentil is an important dietary component and major source of protein. Lentil ranks second in respect of area and production but for consumer's preference its ranks first among all the pulses in Bangladesh (BBS, 2006). Where as, the average yield of lentil in Bangladesh is low. The main causes of decline of lentil area due to cultivation of low yield potential indigenous varieties, poor management practices and crop competition with other crops (Malhotra and Erskine, 1991 and Shoaib, 1992). But Pulses Research Center, Ishurdi, Pabna has developed some high yielding varieties of lentil, but management packages are yet to be developed. In Bangladesh, pulse crops are generally grown without or less fertilizers, manures and irrigation application. Very little work has been done on this crop on fertilizer management which has a great effect on yield. Potash along with nitrogen and phosphate increased the grain yield of lentil (Islam *et al.*, 1985). Timely sowing and lower dose of N-P_2O_5-K_2O (20-40-20 Kg/ha) increased the grain yield of lentil (Rahman *et al.*, 1993). 20 kg/ha N application along with 60 Kg/ha P_2O_5 increased growth and yield of lentil (Verma and Kalra ,1981). Although lentil is generally grown without irrigation but in dry land areas it faces stress condition during germination to different growth stages. In the dry land areas, farmers sporadically use irrigation in lentil field and are getting more yield than conventional practice`s. But there is no scientific document on water management in lentil cultivation in Bangladesh. One irrigation at 3-4 weeks of seedlings along with 40-60-40 Kg/ha of N-P_2O_5-K_2O is effective to achieve higher yield of lentil (Yusuf *et al.*, 1977). Seed priming is one of the techniques which enhanced germination and subsequent crop growth and yield. Seed Priming (seed soaked over night) enhanced germination and crop growth, resulting higher yield of chickpea in Barind region (Musa *et al*.,2001). But there is no integrated management practices on lentil cultivation in dry land areas considering the above findings. So, this present study was designed to determine integrated management practices for economically viable yield of lentil in dry land areas.

MATERIALS AND METHODS

A field experiment was conducted during two consecutive rabi seasons of 2005-06 and 2006-2007 on Calcareous Grey Flood Plain soil of the Pulses Research Centre, Ishurdi, Pabna under rainfed condition. The soil

was sandy loam having pH 7.5, containing 1.2% organic matter,17 ppm N, 26 ppm P and 300 ppm K (Ali *et al.*, 2003).

There were 10 treatment combinations, such as control (T_1) , non-priming with recommended fertilizer dose (RFD) @ 20-40-20 kg/ha of N-P_2O_5-K_2Oduring final land preparation (T_2), seed priming over night with RFD (T_3), fertilizer application @ 20-60-20 Kg/ha of N-P_2O_5-K_2O(T_4), pre-sowing irrigation with RFD (T_5), RFD + post sowing irrigation (T_6), RFD + irrigation at 25 DAE (T_7), RFD + irrigation at 25 DAE + urea top dressed @ 20 kg/ha of N (T_8), fertilizer P_2O_5 application @ 40 kg/ha within line (T_9) and seed priming overnight + broadcast with RFD (T_{10}) were included in the study. The experiment was laid out in RCB design with three replications. The unit plot size was 3m x 4m. Soils were collected before sowing and after harvesting for NPK analysis. Soil moisture was recorded (17.9-18.10%) during seed sowing. The sowing date was 15 November 2005 and 11 November 2006. Fertilizers were used as per treatment. The variety BARI Masur-4 was used with seed rate of 30 kg/ha. The seeds were sown within line apart 25 cm and broadcast as per treatment .Intercultural operations and other operations were done as and when necessary. The crop was harvested on 13 March, 2006 and 12 March, 2007. Data on yield contributing characters were recorded from 10 randomly selected plants from each plot and grain yield (kg/ha) was recorded from whole plot at harvest. All types of variable production costs were recorded to find out the net return and benefit cost ratio. The recorded data were analyzed statistically and mean values were adjudged by Duncan's Multiple Range Test (Gomez and Gomez, 1984). Economic analysis was computed according to Ali *et al*. (2003).

RESULTS AND DISCUSSION

The results of two years and pooled of yield and yield contributing characters of lentil are presented in Table 1 and 2. It appears that incase of soil moisture, at sowing time there was no significant difference in both the years and even pooled results, but numerically the highest soil moisture (18.10 %) was found in T_6 and the lowest (17.90 %) was found in T_1, T_3 and T_8 in 2005-06 and in 2006-07 the highest (18.10 %) was found in T_1, T_5, T_7 and T_9 and the lowest (17.90%) was found in T_3, T_6 and T_{10} and from the combined data of soil moisture at sowing time the highest (18.05 %) was observed from T_5, T_7 and T_9 and the lowest (17.90 %) was in T_3. Differences in plant population of lentil after germination had no significant effect among the treatments in both the years and also in combined results. But numerically the highest plant population (283/m^2, 285/m^2 and 284/m^2) were obtained with T_5 and T_6 and the lowest (278/m^2, 280/m^2 and 279/m^2) from T_1 for 2005-06, 2006-07 and pooled result, respectively. The plant height was significantly influenced by the different management practices. The highest plant height (37.27cm, 43.0cm and 40.14cm) were obtained by T_8 which was identical to those with T_5, T_6 and T_7 in 2005-2006, 2006-07 and pooled result, respectively. But the lowest plant height (31.30 cm, 34.27cm and 32.79 cm) were obtained by control in 2005-06, 2006-07 and pooled result, respectively, where T_2, T_4, and T_9 were identical in 2006-07 and pooled result. In the 2nd year, crop growth was higher than that of 1st year, due to crop was received rain 30 mm during cropping season. In 2005-06, the branches/plant was significantly highest (3.70) in T_8 which was identical to those of T_3, T_5, T_6, T_7 and T_{10}. In 2006-07, the highest branches per plant (4.20) were also recorded in T_8 which was statistically similar to T_5, T_6 and T_7. But the lowest branches per plant (2.16 and 2.73) were obtained by control in 2005-06 and 2006-07, respectively, where T_2, T_4, and T_9 were identical in 2005-06 and T_2 and T_9 were identical in 2006-07. By the combined analysis, the pooled result of branches per plant showed that T_8 also produced the highest branches per plant (3.95) which was statistically similar to T_5, T_6, T_7 and T_{10} and the lowest (2.45) was in control which was identical to T_2 and T_9.

Significantly the highest number of pods per plant (68 and 80) were found in T_8 which was identical to T_5, T_6, and T_7 and the lowest (58 and 69) were recorded from T_1 in 2005-06, 2006-07, respectively, where T_2, T_4, and T_9 were identical in 2006-07 (Table 2) .From the combined analysis, the highest pods/plant (74) were also recorded in T_8 which was similar to T_3, T_5, T_6 and T_7, and the lowest pods per plant (63) also observed in T_1 which was identical to T_2 and T_9. Differences in seeds per pod had no significant effect among the treatments in both the years and also combined result, but numerically the highest seeds/pod (1.81 and 1.90) were in T_8 and the lowest (1.77 and 1.83) were obtained by T_1 in 2005-06 and 2006-07, respectively. From the combined result, increased seeds/pod (1.86) was in T_8 and the lowest (1.80) was in control. The highest 1000-seeds weight (21.40 g) was found in T_8 which was identical to those from T_3, T_5, T_6, T_7 and T_{10}, and the lowest (19.67 g) was obtained by T_1 in 2005-06 and in 2006-07. The highest 1000-seeds weight (22.47g) was found in T_8 which was identical to other all the treatments except T_1 (21.69 g) that was the lowest 1000 seeds weight. From the combined analysis of 1000-seeds weight,T_8 produced the highest (21.94 g) which was statistically similar to T_3, T_5, T_6, T_7 and T_{10}, and the lowest (20.68 g) was found in T_1.The highest grain yield (2152 kg/ha) was obtained by T_8 and the lowest grain yield (1283 kg/ha) was found in T_1 in 2005-06. In 2006-2007, the highest grain yield

(2350 kg/ha) was recorded from the same treatment which was identical to those of T_5, T_6 and T_7 and the lowest grain yield (1522 kg/ha) was recorded from T_1 which was statistically similar to T_2. From the combined result, it was observed that the highest grain yield (2251.0 kg/ha) was also obtained from T_8 which was identical to T_7 and the lowest grain yield (1402.5 kg/ha) was found in T_1.The highest grain yield was obtained from T_8 might be due to the cumulative influence of significant increase of plant height, branches/plant, number of pods/plant, 1000-seeds weight (g) and numerical increase of plant population/m^2 and number of seeds/pod. Yusuf *et al.* (1977) reported that one irrigation at 3-4 weeks of seedlings along with 40-60-40 Kg/ha of NPK is effective to achieve higher yield of lentil. Verma and Kalra (1981) reported that 20 kg/ha N application along with 60 Kg/ha P_2O_5 increased growth and yield of lentil.

Table 1. Effect of different management practices on the ancillary characters of Lentil

Treatment	Soil moisture (%) at sowing time			Plant Population / m^2			Plant height (cm)			Branches/plant		
	05-06	06-07	pooled	05-06	06-07	pooled	05-06	06-07	pooled	05-06	06-07	pooled
T_1	17.90	18.10	18.00	278	280	279	31.30 e	34.27 c	32.79 c	2.16 d	2.73 e	2.45 d
T_2	18.00	18.00	18.00	279	281	280	34.00 cd	35.47 c	34.74 c	2.70 cd	3.00 de	2.85 cd
T_3	17.90	17.90	17.90	281	283	282	35.50 bc	39.83 b	37.67 b	3.20 a-c	3.70 c	3.45 b
T_4	18.00	18.00	18.00	280	282	281	34.20 cd	35.80 c	34.40 c	2.75 b-d	3.20 d	2.98 c
T_5	18.00	18.10	18.05	283	285	284	36.00 ab	42.37 a	39.19 ab	3.30 a-c	4.20 a	3.75 ab
T_6	18.10	17.90	18.00	283	285	284	36.50 ab	41.00 ab	38.75 ab	3.40 ab	4.10 ab	3.75 ab
T_7	18.00	18.10	18.05	280	282	281	36.80 ab	42.50 a	39.65 ab	3.50 a	4.10 ab	3.80 ab
T_8	17.90	18.00	17.95	280	282	281	37.27 a	43.00 a	40.14 a	3.70 a	4.20 a	3.95 a
T_9	18.00	18.10	18.05	279	281	280	34.00 cd	35.40 c	34.70 c	2.70 cd	3.00 de	2.85 cd
T_{10}	18.00	17.90	17.95	282	284	283	35.50 bc	39.90 b	37.70 b	3.30 a-c	3.80 bc	3.55 ab
CV (%)	3.50	3.50	4.09	5.11	6.15	1.31	2.41	3.07	2.85	11.73	5.47	7.26

Table 2. Effect of different management practices on the yield and yield components of Lentil

Treatment	Pods/Plant			Seeds/Pod			1000-Seed Wt.(g)			Grain yield (kg/ha)		
	05-06	06-07	Pooled	05-06	06-07	Pooled	05-06	06-07	Pooled	05-06	06-07	Pooled
T_1	58 d	69 d	63 d	1.77	1.83	1.80	19.67 e	21.69 b	20.68 e	1283 f	1522 f	1402.5 g
T_2	62 c	70 d	66 cd	1.79	1.87	1.83	21.10 c	22.22 a	21.66 cd	1549 e	1761 d-f	1655.0 f
T_3	65 b	77 b	71 ab	1.79	1.90	1.84	21.30 ab	22.44 a	21.87 ab	1689 c-e	2008 bc	1848.5c-e
T_4	64 bc	70 d	67 c	1.76	1.87	1.82	21.15 bc	22.23 a	21.69 cd	1655 de	1811 c-e	1733.0 d-f
T_5	66 ab	79 ab	73 a	1.75	1.90	1.83	21.30 ab	22.45 a	21.88 ab	1869 bc	2250 ab	2059.5 b
T_6	66 ab	79 ab	72 a	1.75	1.90	1.83	21.30 ab	22.44 a	21.87 ab	1822 b-d	2180 ab	2001.0 bc
T_7	66 ab	79 ab	72 a	1.78	1.90	1.84	21.30 ab	22.46 a	21.88 ab	1897 b	2260 ab	2078.5 ab
T_8	68 a	80 a	74 a	1.81	1.90	1.86	21.40 a	22.47 a	21.94 a	2152 a	2350 a	2251.0 a
T_9	62 c	71 d	66.5 cd	1.79	1.88	1.83	20.90 d	22.23 a	21.57 d	1555 e	1780 d-f	1667.5 ef
T_{10}	65 b	74 c	68.5 bc	1.80	1.87	1.84	21.30 ab	22.42 a	21.86 ab	1699 c-e	2091 b	1895 b-d
CV(%)	2.41	1.76	2.59	2.71	7.15	48.94	0.51	2.29	0.37	6.02	7.58	5.55

Economic performance of various treatments under study is presented in Table 3. The highest gross return of Tk. 86080/ha and Tk. 94000/ha were obtained from T_8 in 2005-06 and 2006-07, respectively. The lowest gross return of Tk. 51320/ha and Tk. 60880/ha were obtained from T_1 in 2005-06 and 2006-07, respectively. The highest net return of Tk. 66804/ha and Tk. 72950/ha the highest BCR (4.47 and 4.46) were obtained by the same treatment in 2005-06 and 2006-07, respectively. The lowest net return (Tk. 37285/ha and Tk. 44230/ha) were obtained by T_1 in 2005-06 and 2006-07, respectively but T_4 produced the lowest BCR 3.62 in both the season.

From the results of this study, it may be concluded that, combination of recommended fertilizer dose (20-40-20 Kg/ha of NPK), irrigation at 25 DAE and urea top dressed @ 20 kg/ha of N during irrigation is the optimum management practices for economically viable yield of lentil under Ishurdi condition.

Table 3. Effect of different management practices on the agro-economic performance of lentil cultivation

Treatment	Grain yield(Kg/ha)		Cost of production (Tk/ha)		Gross return (Tk/ha)		Net return (Tk/ha)		Benefit cost ratio (BCR)	
	05-06	06-07	05-06	06-07	05-06	06-07	05-06	06-07	05-06	06-07
T_1	1283	1522	14035	16650	51320	60880	37285	44230	3.66	3.65
T_2	1549	1761	16845	19150	61960	70440	45115	51290	3.68	3.67
T_3	1689	2008	16150	19200	67560	80320	51410	61120	4.18	4.18
T_4	1655	1811	18277	20000	66200	72440	47923	52440	3.62	3.62
T_5	1869	2250	17278	20800	74760	90000	57482	69200	4.33	4.32
T_6	1822	2180	17384	20800	72880	87200	55496	66400	4.19	4.19
T_7	1897	2260	17459	20800	75880	90400	58421	69600	4.35	4.34
T_8	2152	2350	19276	21050	86080	94000	66804	72950	4.47	4.46
T_9	1555	1780	15969	18280	62200	71200	46231	53200	3.89	3.89
T_{10}	1699	2091	15276	18800	67960	83640	52684	64840	4.45	4.44

Price

Urea=6.00 Tk/kg, TSP=20.00 Tk/kg, MP=15.00 Tk/kg, Plough=750.00 Tk/plough/ha, Labour =100.00 Tk/ 8 hour/head, Lentil=40.00 Tk. /kg (non seed) & 50.00 TK. /kg (seed) and one irrigation 750.00 Tk/ha.

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