Effect of Spacing and Nitrogen Level on Growth and Yield of Maize (Zea mays L.) in Mid hill of Nepal

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Abstract:

A field experiment was carried out to study the effect of spacing and nitrogen level on growth and yield of maize in Parbat from February to July, 2019. The experiment was laid out in two Factorial Randomized complete Block Design (RCBD) comprising of spacing: 60×15 cm and 60×25 cm and nitrogen: 30, 60, 90 and 120 kg/ha level as treatment with three replications. "Arun-2" variety of maize was planted on clay loam and acidic soil (pH 5.3) having medium in total nitrogen (0.15%), medium in soil available phosphorus (48.1 kg/ha), medium in soil available potassium (218.8 kg/ha) and medium in organic matter content (2.92%). Result shows that yield was significantly increased with increment in N-level up to 90 kg N/ha. The grain yield (5.18 mt/ha) was significantly higher at 90 kg N/ha than at 30 and 60 kg N/ha but at par with 120 kg N/ha. Significant effect on grain yield due to spacing was observed. The grain yield (4.11 mt/ha) obtained at spacing 60×15 cm. Moreover, the highest grain yield showed that highest grain yield (4.33 mt/ha) was obtained under 90 kg N/ha plus 60×15 cm spacing. The result revealed that different spacing and nitrogen level significantly affect the plant height and leaf area index. The plant height and leaf area index were significantly high at close spacing (60×15 cm) and at 120 kg N/ha. Likewise, yield attributing characteristics like cob length, cob diameter, number of kernel/rows, number of kernel row, thousand gran weight were the highest at 90 kg/ha but as par with 120 kg/ha at close spacing (60×15 cm). This study suggested that maize production can be maximized by cultivating "Arun-2" maize fertilizing with 90 kg N/ha and maintaining 60×15 cm spacing.

Keywords: Maize; Spacing; Nitrogen; Growth; Yield

1.0. Introduction

Maize (Zea mays L.) is one of the most important worlds' widely grown cereal crops and contributes to food security in most of the developing countries. It has high yield potential, there is no cereal on the earth which has so immense potentiality and that is why it is called "queen of cereals" [1]. Maize is the second most important crop in terms of area and production after rice in Nepal [2]. The contribution of cereal crops to Agriculture Gross Domestic Product (AGDP) is about 49.41% whereas maize alone contributes 6.66% to AGDP [3]. Parbat district lies in mid hills of Nepal with suitable climatic for growing maize either as single crop or relayed with finger millet or intercropped with cowpea and pumpkin. Out of total land area, 53.26% (28593 ha) land is cultivable and out of which 45.02% (24171 ha) land is cultivated [4]. In Parbat, Maize occupied topmost position among all cereal in terms of both area (14279 ha) and total production (23072 mt) [4]. So, compairing district productivity of maize (1.62 mt/ha) with National average productivity 2.67 mt/ha, productivity of Parbat lags behind national productivity. Its importance lies in the fact that it is not only used for human food and animal feed but at the same time it is also widely used for corn starch industry, corn oil production, baby corns etc. It is also being recently used in the production of biofuel. Less plant population and poor nutrient management practices are major yield reducing factor in maize [5]. Both thicker and thinner plant density than the recommended ones for a normal production system reduces economic yield. Low nutrients supplied may not be sufficient to exploit the genetic potential of maize [6]. Farmer practice broadcast method of sowing so that optimum plant population can't be maintained at harvest that cause decrease in yield of maize [7]. Therefore, a field study was undertaken to determine the optimum spacing and nitrogen level for maize under mid hill region of Nepal.

1.1. Objectives

1.1.1. General Objective

- To explore the effect of spacing and nitrogen level on yield and yield attributing character on spring maize

1.1.2. Specific Objectives

- To determine the optimum level of Nitrogen for yield and yield attributes of spring maize
- To find out the effect of spacing on yield and yield attributes of spring maize
- To know the interaction effect of spacing and nitrogen level on yield and yield attributes of spring maize

2.0. Materials and Methods

A field experiment was conducted at Mudikuwa, Parbat from February, 2019 to June 2019 lying on geographical coordinate's 28°00' 19''N latitude and 83° 33' 40''E longitude in altitude of 640 masl, and has sub-tropical climate. Sample was taken before sowing of the seeds from each replication and composite sample was made and was analyzed for the initial fertility status of the soil. From soil analysis, Organic matter was found (2.92 %), soil type was a clay loam with pH 5.3, total nitrogen (0.15%), available phosphorus (48.1 kg/ha) and available potassium (218.8 kg/ha). The mean maximum temperature 34ºC, minimum temperature 11ºC and relative humidity ranged from 83.5% to 100%. The total rainfall during crop growing season was 282.6 mm.

The experiment consisted 8 treatments with a combination of two spacing (60×15 cm and 60×25 cm) and four levels of nitrogen level (30, 60 ,90 and 120 kg N/ha) with three replications in two factorial randomized complete block design. Maize was sown in a plot size of 10.8 m^2 (3.6m×3m). FYM was applied as main source of organic fertilizer in the field. The FYM @10kg/plot area was uniformly incorporated into the soil in all experimental plots. Nitrogen, phosphorous and potassium were supplied through urea, Diammonium phosphate (DAP) and Muriate of potash (MOP). The recommended amount of Phosphatic and Potassic fertilizers @ 45:45 kg/ha, were calculated and weighed separately for all treatment. DAP @ 106 g/plot and MOP @ 81 g/plot were applied in all experimental plots. The required amount of nitrogen fertilizer was calculated separately for each treatment. The urea @ 29.11g, 99.54 g, 169.99 g and 240.41 g/plot were applied for 30, 60, 90 and 120 kg N/ha, respectively. The total amount of nitrogen for each plot was divided into three equal parts. First part of nitrogen was used at the time of sowing, second part was applied as side-dress (top dress) at knee high stage and finally last part was side dressed at tasseling stage. As a basal application full dose of phosphorus, full dose of potassium and one third of urea was applied as band placement 5 cm apart from maize row at 5 cm depth. Two manual weeding were done throughout the maize growing period, first weeding was done at 35 days after sowing (DAS) and second weeding and earthing up were performed at 65DAS. First irrigation was done at knee high stage and the second irrigation (light) was done on tasseling stage.

3.0. Results and Discussion

3.1. Biometric Observation

3.1.1. Effect on plant height

Table 1: Effect of different spacing and nitrogen level on plant height of maize at 30, 60 90 DAS at Mudikuwa, Parbat, 2019

S.N.	Treatments	Plant Height (cm)		
		30 DAS	60 DAS	90 DAS
	Spacing			
1	60×15 cm	9.62	90.0	189.5
2	60×25 cm	10.10	85.3	188.0
	SE(d)	0.48	2.82	5.47
	F-test	0.328	0.120	0.786
	$LSD_{(0.05)}$	1.02	6.05	11.74
	N level			
1	30 kg N/ha	9.95	80.5[c]	175.0[c]
2	60 kg N/ha	9.77	84.3[bc]	184.6[bc]
3	90 kg N/ha	10.48	91.4[ab]	197.5[a]
4	120 kg N/ha	9.23	94.5[a]	198.1[a]
	SE(d)	0.67	3.99	7.74
	F-test	0.358	0.013*	0.028*
	$LSD_{(0.05)}$	1.44	8.56	16.61
	CV (%)	4.0	17.2	6.9
	Grand Mean	9.86	87.7	188.8

Note: The treatment mean followed by common letters are not significantly differ from each other based on DMRT at 5 % level of significance.

The results indicated that with each increment of spacing, there was no significant with plant height at 30, 60, 90 DAS, but plant height increased with increasing level of nitrogen in 60 and 90 DAS was significant ($p<0.05$) but non-significant at 30 DAS (Table 1). The lowest plant height of 80.5 and 175cm were observed under 30kg N/ha and the highest plant height of 94.5 and 198.1 cm were observed at 120 kg N/ha at 60 and 90 DAS respectively. Statistically similar plant height was found under 90 and 120kg N/ha at 60 DAS and 90 DAS. Height with increase in rate of nitrogen application due to the positive effect of nitrogen on vigorous vegetative growth and inter-nodal extension due to more availability of N throughout growing period [8].

3.1.2. Effect on leaf area index

Table 2: Effect of spacing and nitrogen level on Leaf area index of maize grown at 30, 60, 90 DAS at Mudikuwa, Parbat, 2019

S.N.	Treatment	LAI		
		30 DAS	60 DAS	90 DAS
	Spacing			
1	60×15 cm	0.16[a]	2.47[a]	4.42[a]
2	60×25 cm	0.09[b]	1.55[b]	2.72[b]
	SE(d)	0.09	0.17	0.25
	F-test	<.001**	<.001**	<.001**
	$LSD_{(0.05)}$	0.02	0.37	0.59
	N level			
1	30 kg N/ha	0.13	1.62[b]	2.89[b]
2	60 kg N/ha	0.12	1.89[ab]	3.58[ab]
3	90 kg N/ha	0.13	2.37[a]	3.95[a]
4	120 kg N/ha	0.11	2.16[ab]	3.86[a]
	SE(d)	0.01	0.24	0.36
	F-test	0.282	0.043*	0.040*
	$LSD_{(0.05)}$	0.03	0.52	0.76
	CV (%)	12.9	12.1	9.1
	Grand Mean	0.12	2.01	3.63

Note: The treatment mean followed by common letters are not significantly differ from each other based on DMRT at 5 % level of significance.

The Leaf area index at 30, 60and 90 DAS were influenced by spacing and nitrogen level (Table 2). With decrease in spacing, there was significantly increment in LAI at all observation. Significantly lowest LAI; 0.09, 1.55 and 2.72 under wide spacing 60×25 cm and the highest LAI: 0.16, 2.47 and 4.42 under close spacing 60×15 cm was observed at 30, 60 and 90 DAS, respectively.

With increment in nitrogen level, there was no significant result with LAI at 30 DAS. But at 60 and 90 DAS, LAI show significant result with different dose of N level. Lowest LAI; 1.62, 2.89 was observed under 30 kg N/ha and highest LAI; 2.89 and 3.95 was observed under 90 kg N/ha at 60 and 90 DAS respectively. Yoshida reported increment in level of LAI with the increasing dose of Nitrogen dose to certain limit [9]. About 50% of all leaf N is directly involved in photosynthesis either as enzymes or as constituents of chlorophyll. High N levels have been reported to increase chlorophyll content of plants that affect cell and tissue growth, thereby influencing leaf area and photosynthetic efficiency LAI was significantly affected and increased in linear fashion with increase in plant population due to occupation of more unit area by green canopy of plants [10]. Increase in level of N fertilizer from 0 to 92 kg N/ha showed increased in LAI however from 92 to 115 kg N/ha showed slight numerical reduction in LAI [8]. Under over dose of N, susceptibility of leaves to down bending and over competition among leaves and other part of plant for other growth factor [11].

3.2. Effect on phenology

3.2.1. Days to 50% tasseling

Table 3: Effect of spacing and nitrogen level on crop phenology of maize grown at Mudikuwa, Parbat, 2019

S.N.	Treatments	Days to 50% tasseling	Day to 50% Silking	ASI	Days to physiological maturity	SFD
	Spacing					
1	60×15 cm	83.25	87.75	4.50	121.17	33.42[b]
2	60×25 cm	82.50	86.83	4.33	121.67	34.83[a]
	SE(d)	0.52	0.64	0.33	0.29	0.63
	F-test	0.174	0.172	0.625	0.103	0.042
	LSD $_{(0.05)}$	1.12	1.37	0.71	0.62	1.35
	N level					
1	30 kg N/ha	84.17[c]	89.33c	5.17[c]	119.00[a]	29.67[c]
2	60 kg N/ha	83.33[bc]	88.17[bc]	4.83[bc]	120.33[b]	32.17[b]
3	90 kg N/ha	82.33[ab]	86.33[ab]	4.0[ab]	123.17[c]	36.83[a]
4	120 kg N/ha	81.67[a]	85.33[a]	3.67[a]	123.17[c]	37.83[a]
	SE(d)	0.74	0.90	0.47	0.40	0.89
	F-test	0.022*	0.002**	0.022*	<.001**	<0.001**
	LSD $_{(0.05)}$	1.59	1.93	1.01	0.87	1.92
	CV (%)	0.8	1.0	6.5	0.2	3.3
	Grand Mean	82.88	87.29	4.42	121.42	34.12

Note: The treatment mean followed by common letters are not significantly differ from each other based on DMRT at 5 % level of significance.

The number of days to tasseling was influenced by spacing and nitrogen level (Table 3). The effect of spacing to tasseling was non-significant. Day to 50 % tasseling and silking, ASI and day to 50% physiological maturity was found to be non-significant with different spacing. These results coincided with finding of [5]. But, effect of N level to tasseling was significant (p<0.01). Significantly shortest period to tasseling (81.67 days) under 120 kg N/ha and the longest period to tasseling (84.17 days) under 30 kg N/ha was observed. Rai, (1961) reported that application of nitrogen as well as increase in its rate induced earliness both in tasseling and silking stages. The more level of nitrogen used, the earlier in days to tasseling was due to rapidness in growth period.

3.2.2. Days to 50 % silking

The number of days to silking was influenced by different spacing and nitrogen level (Table 3). The effect of spacing to silking was non-significant. Day to 50 % tasseling and silking, ASI and day to 50% physiological maturity was found to be non-significant with different spacing. These results coincided with finding of [5].

But with nitrogen level to silking days was significant (p<0.01) Significantly shortest period to silking (85.33 days) under 120 kg N/ha which was at par with 90 kg N/ha and longest period to silking (89.33 days) under 30 kg N/ha were obtained. Rai (1961) reported that application of nitrogen as well as increase in its rate induced earliness both in tasseling and silking stages. The more level of nitrogen used, the earlier in days to tasseling was due to rapidness in growth period.

3.2.3. Anthesis silking interval

Anthesis silking interval as influenced by different spacing and nitrogen level is presented Table 3. The effect of spacing to ASI was found to be non-significant but N level was significant (p<0.05) with ASI. Significantly shortest anthesis silking interval (3.67days) under 120 kg N/ha which at par with 90 kg N/ha (4.0 days) and longest anthesis silking interval (5.17 days) under 30 kg N/ha which at par with 60 kg N/ha (4.83 days) were obtained. Day to 50 % tasseling and silking, ASI and day to 50% physiological maturity was found to be non-significant with different plant populations [5].

3.2.4. Days to 50% physiological maturity

The number of days to physiological maturity as influenced by different spacing and nitrogen level is presented Table 3. The plant spacing to physiological maturity was non-significant. But N level to day to physiological maturity was significant (p<0.01). The Shortest physiological maturity days (119 days) was obtained under 30 kg N/ha and longest physiological maturity days (123.17 days) was obtained under 90 and 120 kg N/ha.

Day to 50 % tasseling and silking, ASI and day to 50% physiological maturity was found to be non-significant with different spacing [5]. Increase in rate of N and number of split applications might have increased rate of photosynthesis that resulted in leaf longevity and delayed phenological characteristics [12]. Shrestha also reported that under high dose of N (200 kg N/ha), plant remained more prolong as green stage and recorded longer maturity period [13].

3.2.5. Seed fill duration

Seed fill duration as influenced by different spacing and nitrogen level is presented Table 3. There was significant effect of spacing and nitrogen level on seed fill duration. The increasing rate of planting population significantly (p<0.05) decreased seed fill duration. The highest SFD (34.83 days) was found in 60×25 cm spacing and lowest SFD (33.42 days) was found in 60×15 cm spacing. Also, nitrogen level to SFD was significantly (p<0.01) increased with increasing nitrogen level. Highest SFD (37.83 days) was found under 120 kg N/ha which at par with under application of 90 kg N/ha (36.83 days) and lowest SFD (29.67 days) was found under 30kg N/ha. Shrestha reported increased physiological maturity and SFD with increasing levels of nitrogen in open pollinated varieties of maize [13]. Delayed maturity at higher nitrogen was because the plant was staying green. Higher nitrogenous fertilizer delays the senescence of leaves and increased succulence of plants.

3.3. Effect on yield attributes

Table 4: Effect of spacing and nitrogen level on yield attributing character of maize grown at Mudikuwa, Parbat, 2019

S.N.	Treatments	No. of cob/plant	Cob Length (cm)	Cob Diameter (cm)	No. of row/cob	No. of Kernel/row
	Spacing					
1	60×15 cm	1.01	15.35[b]	3.94	12.27	21.74[b]
2	60×25 cm	1.03	16.63[a]	4.02	12.48	26.11[a]
	SE(d)	0.01	0.306	0.04	0.16	1.15
	F-test	0.256	<.001**	0.103	0.186	0.002**
	$LSD_{(0.05)}$	0.03	0.656	0.10	0.33	2.47
	N level					
1	30 kg N/ha	1.00	14.01[c]	3.63c	11.72[b]	18.41[c]
2	60 kg N/ha	1.00	15.60[b]	3.99b	12.57[a]	22.01[b]
3	90 kg N/ha	1.02	17.13[a]	4.15[a]	12.75[a]	26.96[a]
4	120 kg N/ha	1.05	17.23[a]	4.16[a]	12.47[a]	28.32[a]
	SE(d)	0.02	0.43	0.06	0.22	1.62
	F-test	0.079	<.001**	<.001**	0.002**	<.001**
	$LSD_{(0.05)}$	0.04	0.93	0.14	0.47	3.486
	CV (%)	1.4	1.7	0.2	1.0	1.5
	Grand Mean	1.02	15.99	3.98	12.38	23.93

Note: The treatment mean followed by common letters are not significantly differ from each other based on DMRT at 5 % level of significance.

3.3.1. Number of cobs/plant

The number of cobs/plants as influenced by different spacing and nitrogen level are presented in Table 4. The result of mean data indicated that the increment in number of cobs/plants with spacing and nitrogen level was non-significant.

3.3.2. Cob length

Cob length as influenced by different spacing and nitrogen level are presented in Table 4. The effect of different spacing and nitrogen level on cob length was significant ($p<0.01$). The cob length increased with each increment in spacing. The wider spacing (60×25 cm) produced the highest cob length (16.63 cm) and lowest cob length (15.35 cm) under close spacing (60×15 cm) was obtained. The data showed that the cob length decreased with increase in plant population due to severe competition for nutrients and increased plant population produced smaller cob due to shading effect. Greater competition between plants for resources like nutrients, solar energy and water might have suppressed the performance of individual performance of individual plants and resulted in smaller cob in closer spacing. The result is in complete agreement with [14].The application of 120 kg N/ ha produced highest cob length (17.23 cm) which at par with cob length (17.13 cm) under 90 kg N/ha and application of 30 kg N/ha produced shortest cob length (14.01 cm) were obtained. Sibale & Smith, (1996) reported significant effect of N on cell and tissue growth and on ear length. Pokhrel (2006) noted the longest ear length (15.64 cm) with 210 kg N/ha.

Interaction between spacing and nitrogen level on cob length was significant ($p<0.01$). The result of interaction (Table 11) showed that the highest cob length (18.10 cm) was noted under 60×25 cm plus 120 kg N/ha. the lowest cob length (12.53 cm) was obtained under 60×15 cm plus 30 kg N/ha.

3.3.3. Cob diameter

Cob length as influenced by different spacing and nitrogen level are presented in Table 4. Variation in cob diameter with different N level was significant ($p<0.01$) with spacing to cob diameter was non-significant. The application of 120 kg N/ha produced highest diameter of cob (4.16 cm) which at par with cob diameter (4.15 cm) under 90 kg N/ha application and application of 30 kg/ha produced lowest diameter of cob (3.63 cm) were obtained. Hati & Panda, (1970) noted the significant increment in cob diameter with increasing level of Nitrogen.

3.3.4. Number of grain row/cob

The number of grain row/cob as influenced by different spacing and nitrogen level are presented in Table 4. The number of grain row per cob was non-significant with spacing but with N level was significant ($p<0.01$). The highest grain row per cob (12.75) were obtained under 90 kg N/ha which at par with 60 and 120 kg N/ha kg N/ha and lowest grain row per cob (11.72) under 30 kg N/ha were obtained. The increase in nitrogen levels increased the kernel rows per cob by better uptake of nutrients and increased translocation of photosynthates from source to sink.

3.3.5. Number of kernel/grain row

The response of maize in term of number of kernels per row due to different spacing and nitrogen level was significant ($p<0.01$) (Table 4). The number of kernels per row decreased with close spacing (60×15 cm). The wider spacing (60×25 cm) produced highest kernel/row (26.11) and lowest kernel/row (21.74) under close spacing (60×15 cm) was obtained. Each increment in N level from 30 to 120kg N/ha results in significantly increased kernel/row. The application of 120 kg N/ha produced highest number of kernels per row (28.32) which at par with 90 kg N/ha which produced (26.96) kernel/row and application of 30 kg N/ha produced lowest number of kernel/row (18.41) were obtained.

3.3.6. Shelling percentage

The variation in shelling percentage with nitrogen level was significant ($p<0.01$) but spacing was non-significant (Table 5). Shelling percentage was highest (77.6%) under application of 90 kg N/ha and lowest (58.5%) under application of 30 kg N/ha which was statistically at par with 60 kg N/ha. The increase in nitrogen levels increased the kernel rows per cob by better uptake of nutrients and increased translocation of photosynthates from source to sink.

3.3.7. Thousand grain weight

Thousand grain weight (g) as influenced by different spacing and nitrogen level are presented in Table 5. The mean data of thousand grain weight with spacing was non-significant but with different nitrogen level was significant ($p<0.01$). The highest thousand grain weight (291.7 g) under application of

120 kg N/ha which at par with 90 kg N/ha (290.3 g) and lowest thousand grain weight (262.5 g) under application of 30 kg N/ha which at par with TGW (272.3 g) under application of 60 kg N/ha were obtained.

3.4. Yield data

Table 5: Effect of spacing and nitrogen level on yield and yield attributing character of maize grown at Mudikuwa, Parbat, 2019

S.N.	Treatments	TGW	Shelling %	Grain yield (mt/ha)	Biological yield (mt/ha)	Harvest index
	Spacing					
1	60×15 cm	276.2	69.0	4.11 [a]	12.37 [a]	31.8
2	60×25 cm	282.2	69.2	3.00 [b]	9.24 [b]	32.3
	SE(d)	4.73	2.96	0.26	0.604	3.16
	F-test	0.232	0.961	0.010*	<.001**	0.886
	$LSD_{(0.05)}$	10.15	6.36	0.80	1.295	6.79
	N level					
1	30 kg N/ha	262.5 [b]	58.5 [c]	1.59 [c]	7.74 [d]	21.9 [c]
2	60 kg N/ha	272.3 [b]	66.5 [bc]	2.95 [b]	10.79 [c]	29.5 [bc]
3	90 kg N/ha	290.3 [a]	77.6 [a]	5.18 [a]	11.60 [b]	44.0 [a]
4	120 kg N/ha	291.7 [a]	73.9a [b]	4.49 [a]	13.40 [a]	32.8 [b]
	SE(d)	6.69	4.19	0.372	0.854	4.47
	F-test	0.001**	0.002**	<.001**	<.001**	0.002**
	$LSD_{(0.05)}$	14.36	8.99	1.13	1.831	9.60
	CV (%)	0.8	5.2	14.1	7.5	10.0
	Grand Mean	279.2	69.1	3.55	10.81	32.0

Note: The treatment mean followed by common letters are not significantly differ from each other based on DMRT at 5 % level of significance.

3.4.1. Grain yield

Grain yield (mt/ha) as influenced by different spacing and nitrogen level are presented in Table 5. The mean data of research finding indicated that significantly ($p<0.01$) highest grain yield (4.11 mt/ha) obtained under close spacing (60×15 cm) and lowest grain yield (3.00 mt/ha) obtained at wider spacing (60×25 cm). The increase in grain yield under decreased spacing might be due to efficient utilization of available resources (nutrient, water and light) [8].

The highest grain yield (5.18 mt/ha) under application of 90 kg N/ha which was at par with application of 120 kg N/ha (4.49 mt/ha) and lowest grain yield (1.59 mt/ha) under application of 30 kg N/ha were obtained. Maximum grain yield/ha (10207.80kg) was achieved at low intra row spacing 20cm under the rate of 115kg N/ha which was statically similar with (9886.90 kg) that produced under 92 kg N/ha. The highest significant mean yields (9.8 mt/ha) were obtained when 92 N kg/ha followed by 115 N kg/ha was applied, but both are statistically at par [16].

3.4.2. Biological yield

Biological yield (mt/ha) as influenced by different spacing and nitrogen level are presented in Table 5. The variation in biological yield due to each increment in nitrogen level and spacing was significant ($p<0.01$). The highest biological yield (12.37 mt/ha) produced under 60×15 cm spacing and the lowest biological yield (9.24 mt/ha) produced under 60×25 cm spacing [7]. Significantly high biological yield (13.40 mt/ha) produced under 120 kg N/ha and the lowest biological yield (7.74 mt/ha) produced under 30 kg N/ha. Highest significant biomass yield (21.2 mt/ha) was obtained at higher nitrogen level 115 N kg/ha [16-20].

3.4.3. Harvest index

Harvest index as influenced by different spacing and nitrogen level are presented in Table 5. The result of mean data indicated that spacing was non-significant with harvest index but with increment in N level was significant ($p<0.01$) with harvest index. The highest harvest index (44.0) was found under application of 90 kg N/ha and lowest harvest index (21.9) was fond under 30 kg N/ha.

4.0. Conclusion

The mean data of research finding indicated that significantly highest grain yield (4.11 mt/ha) obtained under 60×15 cm spacing and lowest grain yield (3.00 mt/ha) obtained at 60×25 cm spacing. Thus, close spacing is suitable for higher yield of “Arun 2” maize in Parbat. Although, the highest grain yield (5.18 mt/ha) under application of 90 kg N/ha which at par with application of 120 kg N/ha (4.49 mt/ha) and lowest grain yield (1.59 mt/ha) under application of 30 kg N/ha were obtained. Therefore, 90 kg N/ha was appropriate dose for “Arun-2” maize cultivation in mid hill of Nepal. Thus, for the cultivation of “Arun-2”, 90:45:45 NPK kg/ha plus 60×15 cm spacing can be used as recommended dose.

5.0. Acknowledgement

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