

Optimizing of Nitrogen for Yield and Yield Component of Rapeseed



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Abstract

Architectural characteristics of plant directly affect inter plant competition and management of rapeseed. Nitrogen rates affect architectural characteristics of rapeseed. Field trial was conducted to examine the impact of nitrogen nutrition on yield and yield component of rapeseed at Palato Research Farm of Agricultural University, Peshawar, Amir Muhammad Khan Campus Mardan during rabi 2014-15. Experiment was based on a randomized complete block design replicated four times. Three levels of nitrogen i.e 0, 75, and 125kg ha⁻¹ were examined in the study. Results of the study showed that maximum pods plant⁻¹, Seed pod⁻¹, 1000-seed weight biological yield, seed yield, and harvest index were observed with nitrogen nutrition of 125kg ha⁻¹. It is concluded that nitrogen nutrition of 125kg ha⁻¹ were considerably produced the highest seed yield and yield component.

Keywords: Seed yield; Pod plant⁻¹; Biological yield and Harvest index.

Introduction

Rapeseed (*Brassica napus L*) belongs to cruciferae family and received a remarkable attention due to oil production as well as forages and meal sources. Rapeseed was grown from 300Bc in Indus valley of Pakistan as a fodder crop and thus is a traditional oil seed crop of Pakistan which is grown in large areas of four provinces of country [1]. It is an important source of protein and oil for human and animal consumption. The total edible oil consumption of the country during 2012-13 was 3.069 million tons while the total edible oil production in the country was 0.567 million tons that is only 18.34% of total availability and the remaining 81.65% is imported [2]. For increasing edible oil production in the county, the oilseed crops cultivation such as rape seed should be encouraged as it suits to the agro-ecological conditions of the country very well however it is mostly grown on marginal land hence poor nutrition might be the primary cause of its lower yield. Suitable cultivars, modern agronomic management and availability of essential nutrients at proper time and optimum amount are central and vital for enhancing seed and oil yield of the crop. Rapeseed required higher amount of nitrogen as compare to cereals. Nitrogen is one of the main precursors of protein and plant take in the form of ammonium or nitrate [3]. Nitrogen fertilizer plays a vital role in enhancing crop yield [4]. Growth traits and seed yield of rapeseed are strongly influenced by nitrogen levels [5]. Optimum nitrogen fertilization leads a rapid growth of the plant canopy and greatly contributes to-word grain filling [6]. Excess nitrogen rate, higher than

optimum growth lead to toxicity however, can reduce grain yield and quality significantly [7]. Adequate application of nitrogen fertilizer can enable the plant to produce rapid leaf growth which can significantly contribute in grain filling [8]. Keeping above facts in view, an experiment was conducted to find out optimum nitrogen level for obtaining higher seed yield and yield component in the agro-ecological condition of Mardan.

Materials and Methods

To study the impact of nitrogen on yield and yield component of rapeseed an experiment was conducted at Palatoo Research Farm of Agricultural University, Peshawar, Amir Muhammad Khan Campus Mardan during winter 2014-15. The experiment was consisted of one factor i.e. Nitrogen levels (0, 75 and 125 kg ha⁻¹). Half of the nitrogen is applied at sowing and half at rosette stages. Seed of improved rape seed cultivar (PARC) at seed rate of 2.5 kg ha⁻¹ was sown on 14th October 2014 in a well prepared and fine seed bed having plot size of 4 m x 2.5 m consist of 5 rows 4 m long and 50cm apart. A basal dose of P at the rate of 60kg ha⁻¹ was applied before sowing at seedbed preparation. Nitrogen and phosphorus was applied from urea and single super phosphate.

Statistical Analysis

Collected data were statistically analyzed using analysis of variance technique appropriate for randomized complete block design. Means were compared using LSD test at 0.05 level of probability, when the F-values were significant.

Results

Data in Table 1 revealed that pod plant⁻¹ was significantly affected by nitrogen, higher application of nitrogen i.e. 125kg ha⁻¹ produces maximum number of pod plant⁻¹ (291.89) followed by 75kg ha⁻¹ (277.11). Statistical analysis of the data in Table 1 showed that nitrogen rate had significant impact on seed pod⁻¹; application of N at rate of 125 kg ha⁻¹ produces maximum seed pod⁻¹. The gradual increase in nitrogen application from 0 to 125kg ha⁻¹ enhances the number of seed pod⁻¹. Data on thousand seed weight of rapeseed in Table 1 indicated that thousand seed weight was significantly affected by nitrogen rates. Increase in thousand seed weight was observed with increments in nitrogen application. Heavier seeds were observed in the plots received 125kg N ha⁻¹, while lighter seeds were noted in the plots received no nitrogen application. The data regarding biological weight as affected by nitrogen is furnished in Table 2. Statistical analysis of the data revealed that nitrogen levels had significant effect on biological yield. Maximum biological yield was recorded with the application of 125kg N ha⁻¹ (6304.22kg ha⁻¹) followed by 75kg ha⁻¹ (6092.44 kg ha⁻¹) and 0kg ha⁻¹ (5660.44 kg ha⁻¹). Data on seed yield of rapeseed are shown in Table 2. Statistical analysis of the data indicated that seed yield was significantly affected by nitrogen levels, Application of nitrogen at the rate of 125kg ha⁻¹ produced higher seed yield (2895kg ha⁻¹) as compare to other treatments. Data in Table 2 indicated the harvest index of rapeseed is significantly affected by nitrogen (Table 2), in the applied nitrogen rate 125kg ha⁻¹ give maximum harvest index (24.20%) followed by 75kg ha⁻¹ (23.00%) and 0kg ha⁻¹ (18.41%).

Table 1: Pod plant⁻¹, seed pod⁻¹ and thousand seed weight of rapeseed affected by N levels .

Treatments	Pods plant ⁻¹	Seeds pod ⁻¹	1000-seed weight (g)
Nitrogen levels (N) kg ha ⁻¹			
0	254 c	15 b	3.24 b
75	277 b	22 a	3.69 ab
125	292 a	24 a	4.58 a
LSD _{0.05}	10.71	3.72	0.9

Table 2: Biological yield¹, seed yield and harvest index of rapeseed affected by N levels.

Treatments	Biological yield (kg ha ⁻¹)	Seed yield (kg ha ⁻¹)	HI (%)
Nitrogen levels (N) kg ha ⁻¹			
0	5660 b	1030 c	18.41 b
75	6092 ab	1388 b	23.00 a
125	6304 a	1512 a	24.20 a
LSD _{0.05}	438.15	112.09	1.92

Discussion

Nitrogen (N) is basic macronutrients responsible for yield and quality of rapeseed. Crop yield and quality decreased with

their deficiency. Balanced fertilization of nitrogen is one of the basic conditions for higher yields and high quality of rapeseed. In this study, we assessed how nitrogen affect yield, yield component of rapeseed. Increasing in pod plant⁻¹ was observed with increments in nitrogen nutrition. The probable reason for this might be due to efficient utilization of nitrogen. These results are in line with [9] reported that number of pod plant⁻¹ increased with increasing nitrogen up to 125kg ha⁻¹. Seed pod⁻¹ significantly increases with higher nutrition of nitrogen due to the fact that nitrogen enhanced the growth of the crop and produced more dry matter that resulted in more seed silique⁻¹. These results conform the finding of [10] reported maximum seed pod⁻¹ with 100 kg ha⁻¹ of nitrogen application. Thousand seed weight varied for nitrogen levels, as nitrogen increase from 0 to 125kg ha⁻¹ increment in grains weight were noted. The probable reason is that higher availability of nitrogen increases the nutrients uptake and enhanced the dry matter accumulation and grain filling process which resulted in heavier grain weight. Our results are in line with [10] observed heavier grains with 100kg ha⁻¹ of nitrogen application. Biological weight significantly enhanced with increasing nitrogen nutrition due to the reason that N increases vegetative growth resulting in more assimilate accumulation and thus resulted in the increased biological yield. These results are in line with [11] stated that biological yield increased with increasing rate of N up to 150kg N ha⁻¹. In term of seed yield the increasing nitrogen rate boast the seed yield of rapeseed. The higher seed yield may be due to efficient utilization of nitrogen by rapeseed. Nitrogen mostly deals with the vegetative growth, as the crop canopy developed and the rate of photosynthesis increase which help in grain filling and higher number of seed pod⁻¹ which influence the final seed yield. Our results are in consistent with [12,13] indicating that increasing nitrogen increases the seed yield. Nitrogen nutrition enhanced harvest index, maximum harvest index was recorded with 125kg N ha⁻¹. Our results are in consistent with [14] stated that increase in N level resulted in higher harvest index.

Conclusion

Nitrogen is one of the most important elements for plant nutrition and development, because it play vital role in plant body, as a constituent of all proteins, nucleic acids and enzymes. The different rates of nitrogen greatly influence the seed yield as well as yield component of rapeseed. Results of the study revealed that the nitrogen fertilizer at the rate of 125kg ha⁻¹ produce maximum yield and yield component. It is concluded from these results that to obtain higher yield of rapeseed the nitrogen should be applied 125kg ha⁻¹ in the agro-ecological conditions of Mardan.

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