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Substitution of Nitrogen Requirement of Wheat (*Triticum aestivum* L.) through Green Manuring

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ABSTRACT

This study was conducted to see the possibility of substitution of nitrogen requirement of wheat through green-manuring during the year 1999-2000. The experimental treatments were control, green manuring only, standard N dose, green manuring + 1/4th of standard N dose, green manuring + 1/2 of standard N dose, green manuring + 3/4th of standard N dose and green manuring + full dose of nitrogen. The results revealed that highest rate of N (120 kg ha^{-1}) along with green manuring produced significantly the highest grain yield ha^{-1}. But at the same time the number of grains per spike, 1000-grain weight and harvest index values exhibited that 60 kg of N applied ha^{-1} after green manuring produced statistically the same results as achieved from the use of 90 or 120 kg of N ha^{-1} along with green manuring.

Key Words: Wheat; N-substitution; Green manuring

INTRODUCTION

To sustain high yield, the soil must contain adequate supply of nutrients. Most of the soils in Pakistan have been exhausted due to continuous crop production and the use of high nutrient demanding crop varieties. The importance of chemical fertilizer in agricultural production cannot be over emphasized however, with fertilizer costs going up, there is need to maintain and possibly increase soil fertility on sustained basis by optimizing all possible organic and inorganic sources for crop production. Green manuring is the most economical means of increasing organic matter content in the soil. It has been observed to maintain and improve soil structure by the addition of organic matter (Repetto, 1986) and to minimize the NPK fixation losses in all types of soil (Dreyfus *et al*., 1983). The crops such as guar, sunhemp, jantar and berseem are commonly raised for this purpose and 70 to 100 kg N ha^{-1} is fixed by these crops (Akhtar, 1989). Green manuring can help to improve physical properties of soil wet-land rice as the incorporation of green manure (*Sesbania aculeate*) increased root density and grain yield of wheat grown after rice (Boparai *et al*., 1992). Optimum rate of N for wheat is the lowest (19.6 kg ha^{-1}) when it is grown after a green manure crop dhancha (Kumar *et al*., 1998). With this in view, the present study was conducte
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comprised of seven treatments viz., control (no green manuring and no fertilizer), green manuring only, recommended N dose (120 kg ha^{-1}), green manuring + 1/4th of recommended N dose (30 kg ha^{-1}), green manuring + ½ of recommended N dose (60 kg ha^{-1}), green manuring + 3/4th of recommended N dose (90 kg ha^{-1}) and green manuring + full dose of nitrogen (120 kg ha^{-1}). A basal dose of phosphatic fertilizer @ 100 kg P_2O_5 ha^{-1} was applied to all the treatments except control at the time of sowing while half dose of N as per treatment was side drilled at sowing and remaining half was side dressed with first irrigation. Rice bean was used as a source of green manuring. It was planted on July 2, 1999 and buried on August 12, 1999. Wheat variety Inqalab-91 was sown on well prepared seed bed with the help of a single row hand drill, using 100 kg seed ha^{-1}, in 25 cm apart rows during the second week of November, 1999. All other agronomic operations were kept normal & uniform for all the treatments. Data on yield and yield components of wheat crop were recorded. Finally the data were subjected to Fisher's Analysis of Variance Technique and treatments' means were compared using Least Significance Difference (LSD) test at 5% probability level (Steel & Torrie, 1984).

RESULTS AND DISCUSSION

Table I. Wheat yield and yield components as affected by green manuring along with nitrogen application

Treatments	Pl. height (cm)	Spike bearing tillers m^{-2}	Number of grains $spike^{-1}$	1000-grain weight (g)	Grain yield (q ha^{-1})	Harvest index (%)
T1 = Control	75.80	221.30* e	45.25 d	36.98 d	33.11 d	38.53 d
T2 = Green manuring only	76.23	234.10 de	48.42 cd	38.44 cd	38.27 c	41.83 c
T3 = Standard N dose (120 kg ha^{-1})	78.87	255.30 cd	53.42 bc	40.13 bcd	46.72 b	45.26 ab
T4 = G.M. + ¼th of recommended N dose (30 kg ha^{-1})	77.47	253.70 cd	50.17 cd	38.66 cd	41.01 c	43.78 b
T5 = G.M. + ½ of recommended N dose (60 kg ha^{-1})	78.19	270.00 bc	55.83 ab	42.35 abc	47.37 b	45.53 a
T6 = G.M. + ¾th of recommended N dose (90 kg ha^{-1})	78.47	289.20 ab	58.67 ab	43.98 ab	49.27 b	45.36 ab
T7 = G.M. + full dose of N (120 kg ha^{-1})	79.08	301.50 a	61.19 a	45.36 a	54.19 a	46.01 a

* = Any two means not sharing a letter in common differ significantly at 5% probability level

were recorded in the treatment where green manuring + full dose of fertilizer (120 kg N ha^{-1}) was applied; whereas, the minimum number (221.3) was recorded in control treatment. Two treatments i.e., green manuring + standard dose of fertilizer (120 kg N ha^{-1}) and green manuring + fertilizer (90 kg N ha^{-1}) however, showed statistically similar results. The improved tillering in these treatments over the control was because of adequate nitrogen availability to plants from green manuring and chemical fertilizer application. Muzaffar (1994) also reported that maximum number of fertile tillers m^{-2} for wheat were recorded where full dose of fertilizer was applied after green manuring. The data presented in Table I further indicate that significantly maximum number of grains per spike (61.19) were produced where green manuring was followed by full dose of fertilizer application (120 kg N ha^{-1}) which did not differ significantly from treatments where 90 or 60 kg N ha^{-1} was applied after green manuring. The control treatment produced the minimum number of grains per spike (45.25) which was also found statistically at par with treatment where either green manuring only or 30 kg N ha^{-1} was applied after green manuring. The increased no. of grains per spike in T_7 (green manuring + 120 kg N ha^{-1}) may be attributed to increased spike length resulting from optimum N availability in this treatment. Khan (1968) reported that significantly maximum number of grains per ear was produced in case of wheat crop when guara, as a green manure crop, was buried into the soil. Data pertaining to 1000-grain weight given in Table I reveal that the maximum 1000-grain weight (45.36g) was obtained from green manuring + fertilizer (120 kg N ha^{-1}) treatment which did not differ significantly from treatment where 90 or 60 kg N ha^{-1} was applied after green manuring. Control treatment produced the minimum 1000-grain weight (36.98 g) but it was statistically at par with treatment where green manuring only, standard dose of fertilizer (120 kg N ha^{-1}) or 30 kg N ha^{-1} was applied after green manuring. These results are supported by those of Javaid (1989) in case of maize crop. A perusal of Table I shows that significantly maximum grain yield (54.19 q ha^{-1}) was obtained in the treatment where green manuring was followed by the application of full dose of fertilizer (120 kg N ha^{-1}) whereas minimum grain yield (33.11 q ha^{-1}) was recorded in control treatment. The treatment where green manuring was followed by 60 or 90 kg N ha^{-1} was found to be statistically at par with that where only full dose of fertilizer (120 kg N ha^{-1}) was used which produced 47.37, 49.27 and 46.72 q ha^{-1} grain yield, respectively. Similarly, Singh *et al*. (1999) found that rice yield and N uptake were highest with green manuring + full dose of fertilizer and Kumar *et al*. (1998) concluded that highest wheat yield was obtained when it was grown after a green manure crop of dhancha. Green manuring or fertilizer treatments showed significant effect on the harvest index value (Table I). Highest harvest index (46.01%) was recorded in treatment where green manuring + full dose of fertilizer (120 kg N ha^{-1}) was applied and it was statistically at par with the treatments receiving green manuring + fertilizer dose @ 90 kg N ah^{-1}, green manuring + fertilizer dose @ 60 kg N ha^{-1} and standard dose of fertilizer (120 kg N ha^{-1}), while the minimum harvest index value (38.53%) was recorded in case of control treatment where no green manuring or fertilizer was applied. This was due to yield increasing trend as exhibited by green manuring and fertilizer applications. These results are in accordance with the findings of Malik (1993) for maize crop.

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