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RESIDUAL EFFECT OF COTTON-MUNGBEAN INTERCROPPING ON SUBSEQUENT WHEAT CROP

M. Yousuf Memon, Parvez Khan, Muhammad Aslam, Muhammad Imtiaz, Nizamuddin, S.H. Siddiqui and S. K. H. Shah

Soil Science Division, Nuclear Institute of Agriculture, Tando Jam-70060, Pakistan
Email: moeedaslam@gmail.com, Telephone No. 022-3880868, 2765750

ABSTRACT

A field study was conducted to assess the residual effect of cotton-mungbean intercropping on subsequent wheat crop. The treatments of the previous long-term experiment were cotton cultivar NIAB-78 alone, NIAB-78 intercropped with mungbean, Chandi alone, cotton CV. Chandi intercropped with mungbean, cotton CV. Sohni alone, Sohni intercropped with mungbean and cotton CV. AEHM-74 alone, and AEHM-74 intercropped with mungbean. Each plot of the previous experiment was divided in three sub-plots for the application of nitrogen at 0, 60 and 120 kg N ha^{-1}. The maximum grain yield of 3.23 tons ha^{-1}recorded with 120 kg N ha^{-1} was significantly higher than 2.74 tons ha^{-1} and 1.13 tons ha^{-1} obtained from 60 kg N ha^{-1} and control treatments, respectively. The wheat grain yield of 1.19 tons ha^{-1} obtained from the plot previously intercropped by cv. Sohni and mungbean gave an increase of 3.5% over its sole cultivation. Highest N uptake of 47.9 kg ha^{-1} was recorded in the treatment where NIAB-78 and mungbean were previously intercropped and was 6% higher than its sole cultivation.

Keywords: Intercropping, Cotton, Mungbean, Residual, Wheat

INTRODUCTION

Intercropping is one of the most common systems of growing crops in tropics, especially in developing countries. It used to be a primitive practice which gave way to sole cropping as a consequence of agricultural development, but recently the importance of intercropping have realized and well planned studies have started worldwide. Of several advantages of this practice, the one least appreciated is the increase in crop yield when grown in association with a legume (Wein and Nangju, 1976; Singh, 1981). Agboola and Fayemi (1972) observed that when maize was intercropped with green gram there was a bigger transfer of nitrogen as compared with cowpea. Research suggested that when two or more crops are grown together, better use of resources is made as compared to when they are grown separately and yield advantages are achieved without using costly inputs (Willey, 1979). The yield advantages in intercropping are substantial when component crops are complementary. The intercrop component, if it is a legume, may benefit the associated non-legume. This research considers the possible beneficial effects of residual soil nitrogen on subsequent crops following such intercropping.

MATERIAL AND METHODS

A field study was conducted during 2004-2005 at the Experimental Farm, Nuclear Institute of Agriculture (NIA), Tando Jam to evaluate the residual effect of previously established cotton-mungbean intercropping system on subsequent wheat crop. Prior to sowing soil samples upto 30 cm depth were collected and analyzed for various physico-chemical properties adopting standard laboratory procedures described by Page *et al*., (1982). The physico-chemical properties of soil showed that soil was non-saline, silt loam having an ECe of 1.02 dS m^{-1}, pH 7.8, organic matter 0.82% and 0.04% total N along with 6.4 µg g^{-1} available P. The experiment was laid out in randomised complete block design with four repeats on previous intercropping treatments of NIAB alone, NIAB intercropped with mungbean, Chandi alone, Chandi intercropped with mungbean, Sohni alone, Sohni intercropped with mungbean, AEHM-74 alone, AEHM-74 intercropped with mungbean. After harvesting the cotton and its intercrop, the field was prepared and wheat CV. sarssabz was sown in lines of 25 cm apart using seed at the rate of 150 kg ha^{-1}. Each plot of the previous experiment was sub-divided in three sub-plots for the application of nitrogen at 0, 60 and 120 kg N ha^{-1}. Nitrogen was applied as urea in two equal splits i.e. half at sowing and half after the first irrigation. Phosphorus and K were applied at recommended rates to all treatments as basal dose at the time of sowing. Normal cultural practices were carried out throughout growth period. The crop was harvested at maturity. Uniform samples of grain and straw were taken and dried in an oven at 70 ^{o}C to a constant weight, ground in Willey's mill and one gram of ground material was digested by modified Kjeldahl method for N determination (Jackson, 1962). The results obtained were subjected to statistical analysis using standard method of analysis (Steel and Torrie, 1986). The differences among the treatment means were compared by using DMR test.

RESULTS AND DISCUSSION

Biological Yield: The results presented in Table-1, showed significant variations in biological yield due to residual and supplemented nutrition in successive wheat crop grown after intercropping of cotton and mungbean. Maximum pooled yield of 8.68 tons ha^{-1} recorded with 120 kg N ha^{-1} was significantly higher than obtained from 60 kg N ha^{-1} (6.72 tons ha^{-1}) and control (2.78 tons ha^{-1}), respectively. Residual effect of previous cropping was also observed which varied considerably depending upon the dominant component of intercropping. The maximum wheat biomass of 3.13 tons ha^{-1} was obtained from the plot where Sohni was intercropped with mungbean giving, an increase of 5% over its sole cultivation. The lowest yield of wheat biomass was recorded from the plots where cotton cultivar AMEH-74 was a dominant component. Similar results were also reported by Waghmare and Singh (1984).

Table 1. Biological yield (tons ha^{-1}) of wheat as affected by N application rates and previous cropping.

Treatments (Preceding crop)	Nitrogen rates (kg ha^{-1})			
	Control	60	120	Mean
NIAB - 78 alone	2.83 gh	6.18 f	9.52 a	6.18 ab
NIAB-78 + Mungbean	2.93 gh	6.28 f	9.58 a	6.26 a
Chandi alone	2.60 hi	6.45 ef	8.40 b	5.32 b
Chandi + Mungbean	2.78 hi	6.65 de	8.50 b	5.96 ab
Sohni alone	2.98 g	6.68 de	8.22 b	5.96 ab
Sohni +Mungbean	3.13 g	6.85 d	8.40 b	6.12 ab
AEHM-74 alone	2.43 i	7.32 c	8.35 b	6.03 ab
AEHM-74 +Mungbean	2.58 hi	7.35 c	8.50 b	6.14 ab
Mean	2.78 c	6.72 b	8.68 a	-

Means followed by different letters in same column are significantly different from each other at 5% level of significance

Grain Yield: The data on the grain yield have been presented in Table-2. Maximum grain yield of 1.19 tons ha^{-1} was recorded from the plots previously intercropped with Cv. Sohni and mungbean, which was higher than the yield obtained from the plots of intercropped Chandi, NIAB-78 and AEMH-74. Similar findings have also bean reported by Waghmare *et al*. (1982), who reported that growth and yield of the wheat crop was better when grown in plots having sorghum-legume intercrops than sole sorghum. The results indicated that nutritional requirements of Sohni were either lower or it has taken up smaller quantities of nutrients due to which the supply of nutrients to the successive crop was better and it flourished well. The response of wheat to the applied N was better marked by significant increase in wheat yield with each increasing level of nitrogen.

Table 2. Grain yield (tons ha^{-1}) of wheat as affected by N application rates and previous cropping.

Treatments (Preceding crop)	Nitrogen rates (kg ha^{-1})			
	Control	60	120	Mean
NIAB - 78 alone	1.12 ij	2.67 h	3.38 a	2.39 ab
NIAB-78 + Mungbean	1.18 i	2.75gh	3.39 a	2.44 a
Chandi alone	1.07 j	2.78 fg	3.23 bc	2.36 ab
Chandi + Mungbean	1.15 ij	2.81 efg	3.28 b	2.41 ab
Sohni alone	1.11 ij	2.75 fgh	3.11 d	2.33 b
Sohni +Mungbean	1.19 i	2.84 ef	3.19cd	2.41 ab
AEHM-74 alone	1.08 j	2.86 ef	3.15 d	2.36 ab
AEHM-74 +Mungbean	1.12 ij	2.84 ef	3.19 cd	2.38 ab
Mean	1.13c	2.74 b	3.23 a	-

Means followed by different letters in same column are significantly different from each other at 5% level of significance

Nitrogen concentration in Grain: The nitrogen concentration in grain (Table- 3) was significantly influenced by all the treatments previously intercropped with mungbean. AEHM-74 + mungbean led to maximum nitrogen concentration in wheat grain followed by Sohni + mungbean, NIAB + mungbean and Chandi + mungbean. Nitrogen concentration increased significantly in wheat with each increase in N applied to the soil. All the intercrops tested

resulted in higher N concentration than their respective monoculture treatments. These results corroborated with the findings of Singh, 1983.

Table 3. N **c**oncentration (%) in grain of wheat as affected by N application rates and previous cropping**.**

Treatments (Preceding crop)	Nitrogen rates (kg ha^{-1})			
	Control	60	120	Mean
NIAB - 78 alone	1.05 fg	1.37 cd	1.63 b	1.35 b
NIAB-78 + Mungbean	1.11 ef	1.45 c	1.70 ab	1.42 a
Chandi alone	0.99 g	1.40 cd	1.65 ab	1.35 b
Chandi + Mungbean	1.17 efg	1.45 c	1.71 ab	1.41 a
Sohni alone	1.05 fg	1.41 cd	1.69 ab	1.38 ab
Sohni +Mungbean	1.10 e	1.43 cd	1.70 ab	1.42 a
AEHM-74 alone	1.15 g	1.36 d	1.69 ab	1.35 b
AEHM-74 +Mungbean	1.22 ef	1.43 cd	1.74 a	1.43 a
Mean	1.07 c	1.41 b	1.69 a	-

Means followed by different letters in same column are significantly different from each other at 5% level of significance

Nitrogen Uptake: The uptake of nitrogen in the cotton crop was enhanced by the intercropping of legume as compared with sole cropping of cooton. Nitrogen uptake was significantly higher in intercrops than their sole cultivation. Among different intercrops under investigation, the maximum N uptake was observed in the treatments where NIAB-78 + mungbean previously intercropped and it recovered 47.9 kg N ha^{-1} followed by AEHM-74 + mungbean, Sohni + mungbean and Chandi + mungbean having uptake of 46.83, 46.51 and 46.14 kg ha^{-1}, respectively. The uptake of nitrogen by wheat was also increased significantly with each increase in nitrogen level. The effect of legume intercrops may be either due to N enrichment of the soil or improvement in biological properties of soil (Wild, 1972).

Table 4. Total N uptake (kg ha^{-1}) by wheat as affected by N application rates and previous cropping.

Treatments (Preceding crop)	Nitrogen rates (kg ha^{-1})			
	Control	60	120	Mean
NIAB - 78 alone	13.85 jkl	45.61 i	76.26 b	45.24 cde
NIAB-78 + Mungbean	15.29 jk	49.02 gh	79.38 a	47.90 a
Chandi alone	12.55 l	47.92 hi	70.72 e	43.73 e
Chandi + Mungbean	15.39 j	50.11 fgh	73.88 bcd	46.14 bcd
Sohni alone	13.89 jkl	48.44 gh	70.53 e	44.29 e
Sohni +Mungbean	14.65 jk	50.71 fg	72.82 cde	46.51 abc
AEHM-74 alone	14.28 kl	49.60 fgh	71.46 de	44.57 de
AEHM-74 +Mungbean	15.56 j	51.76 f	74.50 bc	46.83 ab
Mean	14.12 c	49.14 b	73.69 a	-

Means followed by different letters in same column are significantly different from each other at 5% level of significance

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