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Economic Analysis of Wheat Under Different Nitrogen Levels and Placements

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Abstract: The field study was conducted at Student's Experimental Farm, Sindh Agriculture University, Tandpjam, Pakistan for economic analysis of wheat under different nitrogen levels (80, 120 and 150 kg N ha^{-1}) and placements (broadcast, banding, pop-up and foliar).The study revealed that 120 kg N ha^{-1} applied through banding produced highest physical productivity in terms of grain yield (5400.65 kg ha^{-1}), better revenue productivity (Rs. 41855.03), maximum increase in grain yield (1786.53 Kg ha^{-1}, value = Rs. 13845.60 ha^{-1}) due to banding of 120 kg N ha^{-1} satisfactory net returns (Rs. 21539.03 ha^{-1}) and cost benefit ratio (1:2.96). It was concluded that the economic performance of 120 kg N ha^{-1} was better as compared to other nitrogen levels and placements and it is recommended as farmer guidelines for nitrogen management.

Key words: Wheat, economics, nitrogen, management

INTRODUCTION

There are many factors responsible for yield decrease in wheat. Among them, fertilizer management is considered the major factor. The studies show that 50% increase in yield has been through chemical fertilizers[1,2]. It has been also reported that the method of placement have significant effect on the efficiency of nitrogen fertilizer by increasing the yield. In Alberta, barley yields increased when N fertilizer was banded[3] and net returns were also greater to the producer[4]. Banded fertilizer stimulated plant growth early in the growing season with increased plant N and P concentration and content. As drought conditions developed during the season, there were no grain yield differences due to fertilizer placement and N rate, however, straw yield at harvest was highest with banding[5]. Carefoot *et al.*[6] reported that difference in grain and N derived from fertilizer were related to immobilization of broadcast ammonium nitrate. This depends on the degree of contact between the fertilizer, crop residue and soil moisture levels. Lower recovery of fertilizer N has been attributed to immobilization of N with surface application of fertilizer[7]. Previous research suggests that because of possibilities of increased immobilization of broadcast N, banding fertilizer N below the surface residue layer may be necessary[8]. Efficient use in fertilizer N requires that the contact between fertilizer and crop residue be minimized by placing N below surface[9]. Further, the nitrogen management practices should be performed in a way that one can obtain maximum output with minimum inputs. Looking the economic importance of wheat and nitrogen management practices, the study was conducted for economic analysis of wheat crop under different nitrogen levels and placements.

MATERIALS AND METHODS

The experiment to evaluate the effect of different nitrogen levels and placement methods on wheat economics was conducted at Student Experimental Farm, Sindh Agriculture University, Tandojam, during the Rabi season, 2002-2003. The experiment was laid out in RCBD (strip-split plot arrangement). The treatments were: Factor-A= Nitrogen placements (Broadcast, banding, pop-up and foliar spray). Factor-B= Nitrogen levels (80, 120 and 150 kg N ha^{-1}).

Nitrogen placement methods

Broadcast: This is general practices used by farmers. In this method, N fertilizer from the available urea source was incorporated on the surface of the soil in three split applications, during land preparation, tillering and booting stage.

Banding: In this method N fertilizer from the urea was applied in narrow strips (single row strip) 2" and 2" apart and deep from plant in three split applications, during seed drilling, tillering and booting stage.

Pop-up: In this method N fertilizer was applied in three equal splits. The first split was placed directly with the seed same as seed placed during drilling, however,

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remaining were incorporated during tillering and booting stages as broadcast on moist surface.

Foliar: Foliar feeding refers to spraying nutrient solution on the foliage. In this method granular urea was dissolved with water and solution was split applied, during 20 days of sowing, 30 days, tillering and booting stages.

Economic analysis

Physical productivity: It is generally expressed in term of unit weight of product obtained from a particular crop. The study of physical productivity includes the total yield of wheat crop obtained from N placements and levels.

Revenue productivity: Revenue productivity obtained from a given treatment is referred to the receipts occurred from that specific treatment. It is expressed in terms of money and is calculated by multiplying physical productivity with the prices. Revenue productivity indicates the output in terms of money and is of vital importance in examining the efficiency of treatments. It includes the value of the product offered for sale in market.

Increase or decrease in grain yield: Increase or decrease in grain yield was estimated by subtracting all the treatments from 150 kg N ha^{-1} as a control treatment.

Net returns: Net returns are considered as the most important criteria to examine the efficiency of each treatment. The net returns could be optimized either by minimizing the production cost or by increasing the revenue productivity after selling the product at higher prices. The net returns are calculated by subtracting all expenses from grass income.

Cost benefit ratio: Cost benefit ratio is considered as meaningful criteria to compare the economic efficiency of treatments with different combination of inputs.

RESULTS AND DISCUSSION

Partial economic analysis

Physical productivity: It was revealed that wheat crop produced maximum yield (5400.65 kg ha^{-1}) in case of band application of 120 kg N ha^{-1} followed by broadcast (4851.52 kg ha^{-1}) of 120 kg N ha^{-1} and the minimum grain yield (2567.16 kg ha^{-1}) was observed in case of pop-up of 80 kg N ha^{-1}.

Revenue productivity: According the average per hectare revenue productivities of wheat crop (Rs. 41855.03) maximum revenue was obtained in case of band application of 120 kg N ha^{-1}, followed broadcast of 150 kg N ha^{-1} (Rs. 37599.28) (Table 1).

Yield increase or decrease: The economic analysis showed maximum increase in grain yield (1786.53 kg ha^{-1}, value= Rs. 13845.60 ha^{-1}) due to banding of 120 kg N ha^{-1} as compared to banding of 150 kg N ha^{-1}. The broadcast of 120 kg N ha^{-1} was at the second place which exhibited 1237.4 kg ha^{-1} having the value Rs. 9589.5 ha^{-1}. However, the maximum decrease in grain yield was observed in pop-up and foliar nitrogen placements.

Net returns: It was revealed that high net returns of Rs. 21539.03 ha^{-1} were achieved in case of band application of 120 kg N ha^{-1}. Whereas, broadcast method earned average net returns at the rate of Rs. 18033.28 ha^{-1} of 120 kg N ha^{-1}.

Cost benefit ratio: While comparing economic behaviour of N placement and levels interaction, it was revealed that the wheat crop earned revenue of Rs. 41855.03 ha^{-1} with

Table 1: Partial economic analysis of wheat crop as affected by different nitrogen levels and placements

Treatments	Yield (kg ha^{-1})	Value of yield (Rs. ha^{-1})	Production costs (Rs. ha^{-1})	Yield increase/ decrease over 150+ broadcast recommended (kg ha^{-1})	Value of yield increase/ decrease (Rs. ha^{-1})	Net returns (Rs. ha^{-1})	Cost-benefit ratio
Broadcast 80 kg N ha^{-1}	3419.51	26501.20	18846	-195.61	1515.98	7655.20	1:1.40
Broadcast 120 kg N ha^{-1}	4851.52	37599.28	19566	1237.40	9589.85	18033.28	1:1.92
Broadcast 150 kg N ha^{-1}	3614.12	28009.43	20106	-	-	7903.43	1:1.39
Banding 80 kg N ha^{-1}	3744.53	29020.10	19596	130.41	1010.68	9424.10	1:1.48
Banding 120 kg N ha^{-1}	5400.65	41855.03	20316	1786.53	13845.60	21539.03	1:2.06
Banding 150 kg N ha^{-1}	4321.46	33491.31	20856	707.34	5481.89	12635.31	1:1.60
Pop-up 80 kg N ha^{-1}	2492.22	19314.70	18846	-1121.90	-8694.72	468.70	1:1.02
Pop-up 120 kg N ha^{-1}	3306.40	25624.60	19566	-307.72	-2384.83	6058.60	1:1.30
Pop-up 150 kg N ha^{-1}	2567.16	19895.49	20106	-1046.96	-8113.94	-210.51	1:0.90
Foliar 80 kg N ha^{-1}	3000.64	23254.96	19146	-613.48	-4754.47	4108.96	1:1.21
Foliar 120 kg N ha^{-1}	4299.66	33322.36	19866	685.54	5312.93	13465.36	1:1.67
Foliar 150 kg N ha^{-1}	3242.80	25131.70	20406	-371.32	-2877.73	4725.70	1:1.23

the cost of Rs. 20316 under band application of 120 kg N ha^{-1}. Thus, the wheat crop under band application was efficient enough to yield cost-benefit ratio in the production of 1.296 as compared to other treatments in wheat crop.

Singh and Prasad[10] reported that the better net returns and cost benefit ratio with the application of 80 kg N ha^{-1} as broadcast. Aslam *et al.*[11] suggested that grain potential concentration increased by nitrogen. But the net economic return decreased due to the cost of fertilizer application. Tiwari *et al.*[12] further observed that the highest seed yield and net return with the application of 80, 120 and 150 kg ha^{-1}.

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