International Journal of Advanced Research in Engineering and Applied Sciences

ISSN: 2278-6252
Impact Factor: 4.817

EFFECT OF INTEGRATED USE OF FARM YARD MANURE (FYM) AND CHEMICAL FERTILIZERS (NPK) ON PRODUCTIVITY OF BREAD WHEAT UNDER ARID CONDITIONS

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Abstract: *The effect of integrated use of chemical fertilizers (NPK) and farm yard manure (FYM) on grain yield, straw yield, grain protein content and net profit of wheat was carried out in the Experimental Farm of the Faculty of Agriculture, South Valley University at Qena during two seasons on a sandy soil. The recommended NPK and FYM were applied alone and in various combinations among them. A randomized complete block design, with three replications, was used in this study. Treatments significantly affected grain and straw yields, as well as grain protein content. The highest values of previous traits were obtained from treatment T_4 (50% chemical NPK + 6 tons FYM per ha). Also, this treatment gave the maximum return and net profit per ha compared with the other treatments. Therefore, integrated plant nutrient supply system could help in meeting the goals of balanced fertilization and reduce environmental pollution.*

Key words: *FYM, grain yield, straw yield, grain protein content, profitability.*

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1. INTRODUCTION

Wheat is one of the most important cereal crops in the world and it has the widest distribution among cereal crops. The crop is primarily grown for its grain, which is consumed as human food. Wheat is also the most important cereal crop of Egypt and accounts for about 40.2 % of the total cereal production with acreage of 1.26 million hectares. Bread wheat (*Triticum aestivum,* L.) account for about 92.14 % of the wheat cultivated area in Egypt [1]. Increasing grain yield of wheat is an important national goal to face the continuous increasing food needs of Egyptian population.

Sustainable agricultural productivity might be achieved through a wise use of integrated nutrient management. It enhanced plant growth, water, and soil and land management [2]. The use of organic soil amendments has been associated with desirable soil properties including higher plant available water holding capacity and cation exchange capacity and lower bulk density, and can foster beneficial microorganisms [3], [4]. Organic fertilization was found to be favorable for enhancing growth and productivity of wheat [2], [5]-[7]. Application of Farm yard Manure helps to increase the DMP, yield and nutrient uptake by wheat [8]. Also, the application of organic fertilizer increased grain protein content [9], [10]. The combination of mineral fertilizers, with organic manures, helped in increasing the grain yield of wheat and implied a saving of 50% cost, compared to a system with only mineral fertilization [11]. The present work was carried out to study the effect of integrated use of chemical and organic fertilizer on productivity and profitability of wheat at newly reclaimed sandy soils as well as reduce environmental pollution.

2. MATERIALS AND METHODS

2.1 Experimental site description

The investigation was carried out at the experimental farm of the Faculty of Agriculture, South Valley University at Qena Governorate, Egypt, during two seasons (2010-11 and 2011-12). The farm is located at an altitude of 79 m above mean sea level and is intersected by 26°10’ N latitude and 32°43’ E longitude. The soil of the experimental site is sandy-loam throughout its profile (74.4 % sand, 15.8 % silt and 9.8 % clay), with a pH value of 7.77, 2.62 EC (dSm-1), 0.42% organic matter content, 0.34% total N, 7.98, 186 ppm available P and K, respectively.

2.2 Experimental treatments and design

The experiment was carried out in a randomized complete block design with three replications. Experimental unit measured 3.0 m in width and 4 m in length. The treatments details are presented in Table 1.

Table 1: Details of various treatments

Treatment	Detail
T_1	Recommended NPK (238: 78: 100 kg ha^{-1})
T_2	12 tons FYM (Farm yard manure)
T_3	25% NPK + 9 tons FYM
T_4	50% NPK + 6 tons FYM
T_5	75% NPK + 3 tons FYM
T_6	Control (without NPK or FYM)

2.3 Cultural practices

Bread wheat (Giza 168 cv.) was sown on the 15th of November in both seasons. Whole of phosphorus and potassium were applied basally before sowing in all treatments. Nitrogen fertilizer was applied in three equal doses; the first, during soil preparation, and the second and third after 21 and 63 days from sowing, respectively. The other cultural practices were carried out as recommended for the crop.

2.4 Measured traits

At harvest time, grain and straw yields were estimated at plot basis. Grain protein content on dry matter basis was determined by the Kjeldahl method according to AOAC [12]. For economic evaluation, a variable and fixed costs (land preparation, irrigation, harvesting, land rent, etc.), as well as total return, included price of grain and straw yields were estimated from tables of Agricultural Statistics, Economic Affairs Sector (EAS), Ministry of Agriculture and Land Reclamation, Egypt.

2.5 Statistical analysis

The data were analyzed by analysis of variance using MSTAT-C statistical software. Treatment means were compared using Duncan's multiple tests [13]. Probability levels lower than 0.05 or 0.01 were held to be significant. Since data followed the homogeneity test, pooling was done over the seasons and mean data are given.

3. RESULTS AND DISCUSSION

3.1 Grain and straw yields

From the pooled data of grain (4.475 tons ha^{-1}) and straw (7.212 tons ha^{-1}) yields per ha, it is inferred that application of NPK fertilizers in integrated treatment T_4 (50% NPK + 6 tons FYM) was found to be statistically and numerically superior to other treatments (Table 2). The minimum and significantly lower grain (2.450 tons ha^{-1}) and straw (4.186 tons ha^{-1}) yields per ha were recorded in control (without NPK or FYM) than other treatments. Grain and straw yields under organic treatment alone (T_2) were significantly higher than control (T_6) and lower than chemical (T_1) and integrated treatments (T_3, T_4, T_5). Such increase in grain and straw yields, due to application of T_4, might be due to the role of organic fertilizer in enhancing soil biological activity, which improved nutrient mobilization from organic and chemical sources. These results are in harmony with the findings of Zahoor [2], Regar [5] and Nawab [7]. Also, Kiani [11] found that combination of mineral fertilizers with organic manures helped in increasing the grain yield of wheat and implied a saving of 50% cost, compared to a system with only mineral fertilization.

Table 2: Effect of integrated use of organic and chemical fertilizers on grain yield, straw yield and grain protein of wheat (data over two seasons)

Fertilization treatments	Grain yield (ton ha^{-1})	Straw yield (ton ha^{-1})	Grain protein content (%)
T_1- Recommended NPK	4.475 b	7.212 b	11.91 a
T_2- 8 tons FYM (Farm yard manure)	3.850 c	6.425 c	11.65 a
T_3- 25% NPK + 6 tons FYM	3.975 c	6.685 c	11.83 a
T_4- 50% NPK + 4 tons FYM	4.750 a	7.510 a	11.98 a
T_5- 75% NPK + 2 tons FYM	4.350 b	7.150 b	11.95 a
T_6- Control (without NPK or FYM)	2.450 e	4.180 e	11.01 b

The same letters within columns means not significant differences at 5% level.

3.2 Grain protein content (%)

The results in Table 2 indicated grain protein content under organic treatment alone (T_2), chemical fertilizer (T_1), and integrated treatments (T_3, T_4, T_5) were significantly higher than control (T_6). The minimum and significantly lower grain protein content (11.01 %) was recorded in control (without NPK or FYM) than other treatments. The results obtained by El-Bagoury [9] and Yakout [10] agreed with these results and they concluded that grain protein contents responded to organic matter application.

3.3 Economic evaluation

The results in Table 3 indicated that maximum return and net profit per ha of 17273 and 8198 L.E., respectively, were obtained from treatment T_4 (50% NPK + 6 tons FYM). The minimum return and net profit per ha of 9161 and 2259 L.E., respectively were recorded in control (without NPK or FYM) than other treatments. Also, the highest value of return-cost ratio (1.90) was obtained by the application of T_4, while, the lowest (1.33) was obtained from T_6 (control). The highest return and net profit values observed in the T_4 treatment can be attributed to the increases in grain and straw yields produced per unit area under this treatment (Table 2). These results are in agreement with those reported by Shah and Ahmad [14] who found that integrated use of urea and FYM at 75:25 or 50:50 ratios (N basis) had produced maximum yields and was, then, recommended for profitable wheat grain yield.

Table 3: Some economics of wheat productivity per ha at various treatments (data over two seasons)

Treatments	Total costs (L.E ha^{-1})	Return (L.E* ha^{-1})			Net profit (L.E ha^{-1})	Return-cost ratio
		Grain	Straw	Total		
T_1- Recommended NPK	9106	10472	5914	16386	7280	1.80
T_2- 8 tons FYM (Farm yard manure)	9048	9009	5268	14277	5229	1.58
T_3- 25% NPK + 6 tons FYM	9060	9302	5482	14784	5724	1.63
T_4- 50% NPK + 4 tons FYM	9075	11115	6158	17273	8198	1.90
T_5- 75% NPK + 2 tons FYM	9090	10179	5863	16042	6952	1.76
T_6- Control (without NPK or FYM)	6902	5733	3428	9161	2259	1.33

*1 L.E. (One Egyptian pound) = $ 0.143

4. CONCLUSION

Generally, it cane be concluded that application of 50% of chemical NPK + 6 tons FYM per ha on wheat gave the highest values of grain and straw yields as well as grain protein content. Also, this treatment gave the maximum return and net profit per ha. Thus, 50 % of chemical NPK was replaced by FYM.

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