



## ORIGINAL ARTICLE

# Effect of Green Manure and some Chemical Fertilizers on the Wheat Yield and some of its Components in Iran- North of Khuzestan

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### ABSTRACT

*In farm year of 2010-2011, an experiment was performed in the farm lands around Mohammad Ibn Jafar Tayar small town, locating in 6<sup>th</sup> kilometer of Dezful city, to consider the effect of green manure and chemical fertilizers of Nitrogen and Phosphorous on the wheat yield and some of its components. The research was performed in Split Plot Factorial experiment in three repetitions. Two mungbean cultivation with green manure (in 3 of July, 10 of August) and fallow as the main plot and three levels of Nitrogen (0, 60, 120) kg/ha of pure Nitrogen was regarded as the first factor and three levels of Phosphorous fertilizers (0, 45, 90) kg/ha of pure Phosphorous as the second factor. Properties of spike numbers ( $m^2$ ), spikelet numbers in the spike, the weight of 1000 seeds, biological yield and index of the harvest were considered. The effect of green manure did not become meaningful on all the treatments under consideration. But the effect of Nitrogen and Phosphorous fertilizers on the spike numbers ( $m^2$ ), spikelet numbers in the spike, seed and biological yield became meaningful while it did not do on the weight of 1000 seeds. The effect of Nitrogen fertilizers on the harvest index became meaningful and it did not do in the case of Phosphorous fertilizer on this treatment. Maximum yield was achieved in 3 of July cultivation in which green manure with the most amount of Nitrogen 120(kg/ha) as well as the most amount of phosphorous 90 (kg/ha) were used. Seed yield correlation with spike numbers ( $m^2$ ), spikelet numbers in the spike, weight of 1000 seeds, biological and index yield of the harvest at the level of 1% became positive and meaningful.*

**Key words:** wheat, green manure, yield, yield components, Nitrogen, Phosphorous

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### INTRODUCTION

Wheat is one of the oldest and most valuable plants on the earth which is cultivated and has an important role in the human food ration more than any other product (5). Economic importance of wheat, whether its product or nutrition, is more than Wheat seed has the main role in the providing human food. Wheat straw and bran is used for domesticated animals; meanwhile, the straw is used in the paper and cardboard factories (1). Nitrogen is a component of Amino Acids ingredients which are the constructive unites of proteins. Lack of Nitrogen is one of the most current nutrition tensions (3). Phosphorous is a necessary element for plan and it is, also, the most important element in the production. Phosphorous has a key role in all bio-chemical processes, energetic compounds, and construction and energy transition operations (4). Increase in the organic materials of the soil increases the product sustainability in the wheat cultivation systems. Keeping the organic materials of the soil is possible through increasing the plant remains (2). Green manure, in fact, is an agricultural plant which is planted to improve the status of the farm soil and supply a part of the necessary nutrition materials of the next agricultural plant. Cultivation of Leguminous plant family as the green manure not only increases Nitrogen to the soil subsequently its biological fixation but also increases the soil organic materials [1, 8]. The existing phosphorous in the organic compounds of the green plants provides a changeable and absorbable form for the next plant. Organic Phosphorous is gradually transformed into the mineral Phosphorous through the mineralization process and it is absorbed by the next plant [2]. A major part of the existing food elements in the green manure will be exposed to the next plant, if there is a suitable temperature and wetness for analysis of plant tissues of green manure. Some researchers have reported the possibility of

disposal of a part of this food material to the next cultivation [3][6]. Sing et al. (1992) concluded that cultivation of Logom as green manure increases the available nutrition of the wheat as well as soil organic materials [9].

## MATERIALS AND METHODS

In farm year of 2010-2011, the experiment was performed in the farm lands around Mohammad Ibn Jafar Tayar small town, locating in 6<sup>th</sup> kilometer of Dezful city, to consider the effect of green manure and chemical fertilizers of Nitrogen and Phosphorous on the wheat yield and some of its components. Experiment place is located in the latitude of northern 32 degrees and 31 minutes and longitude of eastern 48 degrees and 31 minutes. Its height from sea level is about 143 meters. Soil tissue was determined as Clay Loam before gram cultivation. The research was performed in Split Plot Factorial experiment with three repetitions. Two mungbean cultivation with green manure (in 3 of July, 10 of August) and fallow as the main plot and three levels of Nitrogen (0, 60, 120) kg/ha of pure Nitrogen was regarded as the first factor and three levels of Phosphorous fertilizers (0, 45,90) kg/ha of pure Phosphorous as the second factor.

Chamran variety of wheat and Omrani variety of gram were cultivated. The amount of cultivated wheat seeds was determined with density of 400 seeds (m<sup>2</sup>) based on the research recommendation. The amount of gram seed for cultivation was 100 (kg/ha). Nitrogen fertilizers from urea sources and Phosphorous from super Phosphat triple were added to the soil in terms of fertilizer treatment amount. Half of Nitrogen fertilizer and all Phosphorous fertilizer in the form of rootstock were distributed after the first disk. Rest of Nitrogen fertilizer in each fertilizer treatment was used in the form of Top dressing in the stage of shooting 1/2(m<sup>2</sup>). Mungbean was returned to the soil by plowing in the middle of its blooming stage and it was shattered and mixed with soil by Rotiyator. Wheat was cultivated in the form of border in 6 of December. Fighting operation against biological pests was performed by use of *Coccinella septempunctata*. Fighting operation against the weeds was mechanically and without any venom.

Dry weight of gram, before mixing with soil, was measured (m<sup>2</sup>). To determine the amount of seed yield and its components, harvest was performed in the final maturity and after elimination of beginning and terminal half meter from third and fourth lines in the level of ½ m<sup>2</sup>. Statistic analysis of the research was performed by use of statistical software of SAS and diagrams and histograms were drawn by use of Excel. Also, mean comparison was performed by use of multi- domain Duncan.

## RESULTS AND DISCUSSIONS

The results of variance analysis in the table (1), which was achieved for various effects of green manure, Nitrogen and Phosphorous fertilizers, showed that the effect of green manure on spike numbers, spikelet numbers, seed numbers in spike, seed yield did not become meaningful.

Effect of Nitrogen fertilizer on spike number (m<sup>2</sup>), spikelet numbers in spike, seed yield, biologic and index yield of harvest in the level of 1% did not become meaningful but it did not do on weight of 1000 seed. Effect of Phosphorous fertilizer on spike number, seed and biological yield at the level of 1% and on the spikelet number in the spike at level of 5% became meaningful but it did not do on the weight of 1000 seeds and the harvest index. In this table (1), reciprocal effects between green manure and Nitrogen fertilizer did not become meaningful in all regarded treatments. Also, reciprocal effects between green manure and Phosphorous fertilizers became meaningful only in the biological yield at the level of 1% but it did not do on the rest of the treatments. Moreover, effects between Phosphorous fertilizer with Nitrogen and reciprocal effects between green manure with Nitrogen and Phosphorous fertilizer did not become meaningful in all treatments.

Table 1: Analysis of variance for grain yield and yield components

S.O.V	d.f	Mean Square					
		Seed number (m <sup>2</sup> )	Spikelet number in the spike	Weight of 1000 seed (g)	Seed yield (g/m <sup>2</sup> )	Biological yield (g/m <sup>2</sup> )	Yield Harvest
Replication	2	278	0.08	0.33	32155	98758	55.42
Green manure (G)	2	21395 <sup>ns</sup>	5.93 <sup>ns</sup>	9.03 <sup>ns</sup>	41247 <sup>ns</sup>	121080 <sup>ns</sup>	84.35 <sup>ns</sup>
E <sub>G</sub>	4	10105	3.79	10.64	19104	42681	158.59
Nitrogen (N)	2	62768 <sup>**</sup>	8.9 <sup>**</sup>	4.70 <sup>ns</sup>	87749 <sup>**</sup>	247356 <sup>**</sup>	163.75 <sup>**</sup>
Phosphorus (P)	2	22570 <sup>**</sup>	0.82 <sup>*</sup>	4.33 <sup>ns</sup>	17592 <sup>**</sup>	10202 <sup>**</sup>	95.75 <sup>ns</sup>
G×N	4	1245 <sup>ns</sup>	1.32 <sup>ns</sup>	0.74 <sup>ns</sup>	8022 <sup>ns</sup>	55053 <sup>ns</sup>	26.75 <sup>ns</sup>
G×P	4	1319 <sup>ns</sup>	1.03 <sup>ns</sup>	1.03 <sup>ns</sup>	1025 <sup>ns</sup>	5120 <sup>**</sup>	8.48 <sup>ns</sup>
P×N	4	4724 <sup>ns</sup>	0.82 <sup>ns</sup>	5.09 <sup>ns</sup>	792 <sup>ns</sup>	6176 <sup>ns</sup>	39.05 <sup>ns</sup>
G×N×P	8	815 <sup>ns</sup>	1.11 <sup>ns</sup>	2.21 <sup>ns</sup>	1480 <sup>ns</sup>	2443 <sup>ns</sup>	15.99 <sup>ns</sup>
E	48	4077	1.09	3.65 <sup>ns</sup>	3900 <sup>ns</sup>	13143 <sup>ns</sup>	53.29 <sup>ns</sup>

\*Meaningful in level of 1%, \*\*Meaningful in level of 5%, n.s no meaningful difference

Comparison of the means between properties of table (2) shows that for the date of green manure cultivation and fallow on treatments of spike numbers, spikelet numbers in spike, seed and biological became meaningful but it did not do on the weight of 1000 seeds and harvest index the most effects of which was in the cultivation in 3 of July. These observed properties in the table show that green manure increases spike numbers ( $m^2$ ), seed and biological yield. Miller et al. [4] believe that the cultivated plants in the last years can improve the yield of the next plant through providing the different conditions in the soil (Nitrogen, Organic material, the amount of available water) (10).

On the whole, we can say that cultivation of green manure in comparison with fallow land before wheat cultivation was meaningful. In the dates of green manure cultivation (3 of July and 10 of August), it was observed that the best cultivation date was due to 3 of July.

Environmental conditions as soil temperature and the amount of biomass of green manure have special importance in the amount of organic materials and Nitrogen supply. Ross et al. [5] concluded the relation between the date of green manure and these two parameters (11). In this conditions, use of adequate green plant, more tillage, change in density of green plant and even more important, choice of adequate cultivation date of green manure is possibly resulted in the increase in efficiency of Nitrogen application. Therefore, these effects of green manure depends on the conditions as in this experiment was in the 3 of July cultivation.

Table 2: Mean comparison for grain yield and yield components

Treatments	Means					
	Seed number ( $m^2$ )	Spikelet number in the spike	Weight of 1000 seed (g)	Seed yield ( $g/m^2$ )	Biological yield ( $g/m^2$ )	Yield Harvest
<i>Green Manure</i>						
<b>Fallow</b>	392b	11.6b	38a	404b	763b	48a
<b>3 Jul</b>	449a	11.7b	39a	477a	897a	49a
<b>10 Aug</b>	422ab	12.5a	38a	417b	825ab	48a
<i>N (kg ha<sup>-1</sup>)</i>						
<b>0</b>	371c	11.3b	37a	369b	740b	46b
<b>60</b>	427b	12.1a	38a	449a	813b	50a
<b>120</b>	467a	12.3a	39a	480a	930a	48ab
<i>P (kg ha<sup>-1</sup>)</i>						
<b>0</b>	391b	11.8a	38a	405a	808a	46a
<b>45</b>	424ab	11.8a	38a	437a	830a	48a
<b>90</b>	449a	12.1a	39a	456a	847a	50a

**In each column and for each experimental factor, the means which have a common letter are lack of statistical difference based on the Dunken's Test at the level of 5%.**

Different effects of Nitrogen levels (0, 60, 120) kg/ha was meaningful in all regarded treatments were meaningful but the weight of 1000 seeds namely increase in Nitrogen amount was resulted in increase of spike numbers ( $m^2$ ), spikelet numbers in spike, biological and seed yield. Edalat et al. [6] expressed that agricultural alternation had a meaningful effect on the wheat biologic yield and Nitrogen application increases it. Also, the most increase of characteristics in Nitrogen treatment was due to level of 120 (kg/ha) and the least increase was due to the levels of without Nitrogen. On the whole, by affecting the yield components, Nitrogen treatment increases the seed yield. These results correspond with the other researchers' results (12). As it is observed in the table (2), the effects of the various levels of Phosphorous (0, 45, 90) Kg/ha were meaningful only in the spike number ( $m^2$ ) and it did not become meaningful in other treatments, although increase in Phosphorous amount caused positive increase of treatments. Diagrams (1, 2) show the effects of green manure and Nitrogen and Phosphorous levels on the harvest index, biological yield, and diagram 3 shows the different effects of the cultivation date of green manure as well as Phosphorous and Nitrogen levels for the seed yield.

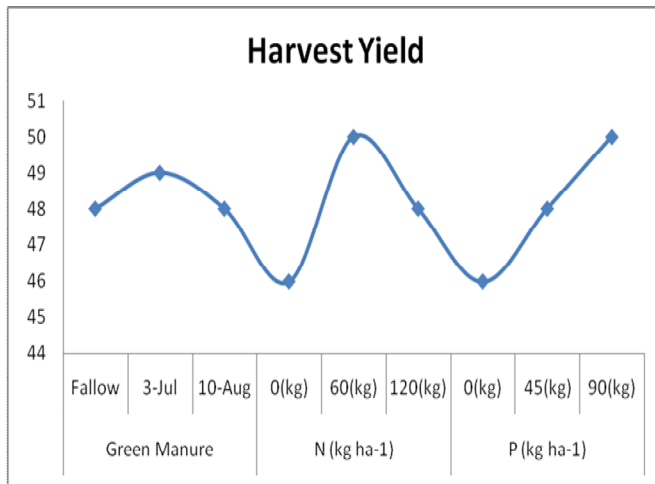


Diagram (1): The effects of different fertilizers of the Harvest Yield

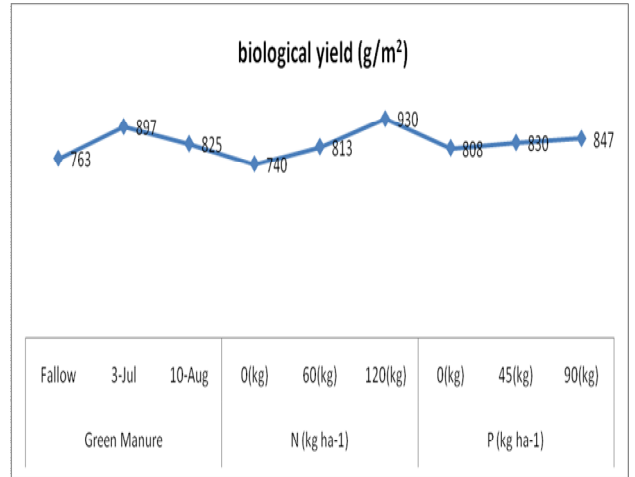
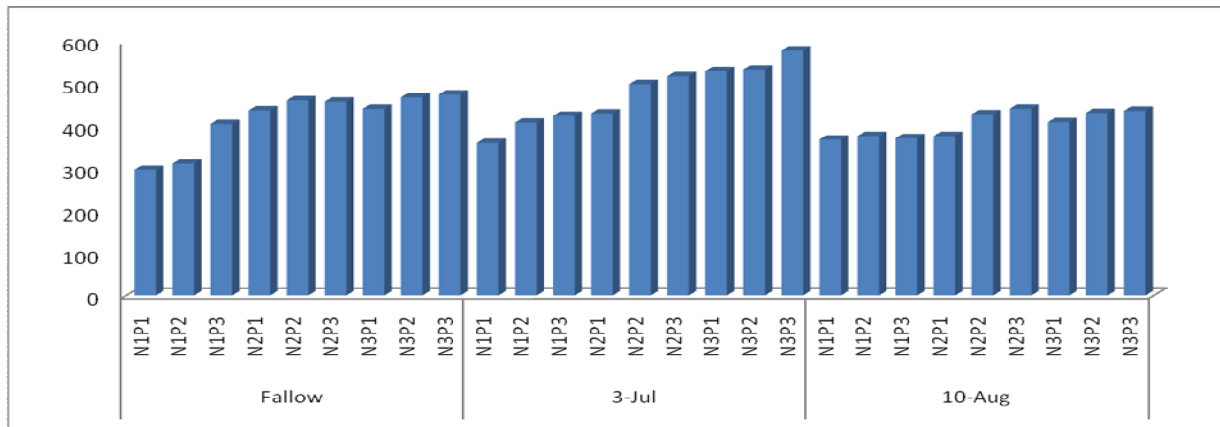


Diagram (2): The effects of different fertilizers of the biological yield (g/m²)



Green manure (fallow,3Jul ,10Aug), Phosphorus (P1 = 0 , P2 = 45 , P3 =90) , Nitrogen (N1 = 0 , N2 = 60, N3 =120)

Diagram (3): The respiratory effects of different fertilizers on the seed yield (g/m²)

The results of correlation impact experiment in table 3 show that the correlation of the seed yield, spike number (m<sup>2</sup>), spikelet number in the spike, weight of 1000 seeds, biologic yield and harvest index became meaningful and positive at the level of 1%. Also, correlation impact of spike number (m<sup>2</sup>) and spikelet number in the spike at the level of 5% as well as biologic yield at the level of 1% became meaningful and positive but it was not for weight of 1000 seeds and harvest index. Correlation impact of weight of 1000 seeds with biological and harvest index at the level of 5% became positive and meaningful. Correlation impact of biological yield with harvest index at the level of 5% became positive and meaningful namely increase in the yield was resulted in the reduction of the harvest index. Therefore, meaningfulness and positiveness of the treatments increase the yield. Therefore, the experiment, on the whole, shows that the green manure cultivation in 3 of July and the most Nitrogen fertilizer-namely 120 (kg/ha) as well as Phosphorous-namely 90 (kg/ha) had the most yield. Diagrams 1, 2, 3 show the effects of the green manure, Phosphorous and Nitrogen on the harvest index, biological yield as well as reciprocal effects of green manure and levels of Nitrogen and Phosphorous fertilizers on the seed.

Table (3) of correlative impact of treatments

Properties under consideration		1	2	3	4	5	6
1	Seed yield	1					
2	Spike number	0.425**	1				
2	Spikelet numbers in the spike	0.541**	0.263*	1			
4	Weight of 1000 seeds	0.368**	0.50 <sup>ns</sup>	0.297**	1		
5	Biological yield	0.694**	0.336**	0.408**	0.219*	1	
6	Harvest index	0.510**	0.191 <sup>ns</sup>	0.248*	0.249*	-0.253*	1

\*\* Meaningful in level of 1%, \*Meaningful in level of 5%, n.s no meaningful difference

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