Study Of Nutrient Accumulation In The Aerial And Forage Yield Affected By Using Of Nitroxin, Supernitro Plus And Biophosphor In Order To Reduce Consumption Of Chemical Fertilizers And Drought-Resistant In Corn (KSC-704)

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ABSTRACT

The aim of this studies was to evaluate effect of nitroxin, super nitro plus and biophosphorus on yield and yield components of maize (Zea mays) under different levels of chemical fertilizers in the condition of normal and deficient irrigation. Experiment laid out as split plot factorial based on randomized complete block design with three replications. Main plots includes two irrigation treatments of 70 (I1), 120 (I2) mm evaporation from class A pan. Sub plots were biological fertilizer and chemical fertilizer as factorial biological fertilizer consisting of nitroxin (Azospirillum lipoferum, Azospirillum brasilens, Azotobacter chroococcum and Azotobacter agilis (10^8 CFU ml^-1) (B1), super nitro plus (Azospirillum spp, + Pseudomonas fluorescence + Bacillus subtilis (10^6 CFU ml^-1) + biological fungicide) (B2), biophosphorus (Pseudomonas spp + Bacillus spp (10^7 CFU ml^-1) (B3), and chemical fertilizer consisting of NPK (C1), N5oP5oK5o (C2) and NoPoKo (C3). The results showed that usage of biological fertilizer could increase absorb nutrient in biomass. Also usage of biological fertilizer increase forage yield under normal and drought stress in corn.

Key words: Nitroxin, Supernitro plus, Biophosphor, Forage yield, Nutrient, Corn

Introduction

Given the rapidly increasing population needs to produce more and strategically important crops like wheat and corn will feel more. Unfortunately, in Iran increased production has always been associated with increased cultivation, or is associated with the use of more pesticides and chemical fertilizers.

Overuse of chemical fertilizers and pesticides have had a lot of harm to the environment and public health. Statistical spread of diseases such as cancer, digestive and respiratory show this. According to statistic in Iran in every year, 34,000 people die from cancer, that 90% of those are residents of Golestan, Mazandaran, Gilan provinces and Moghan plain, that 50% of these chemical fertilizers and pesticides used in these areas. However, more than 400 million dollars annual subsidy paid by the government as long as the manure fertilizer consumption in Iran is several times of global standards. Currently, each year more than 4.4 million tons of fertilizer used in the country. That figure compared with 2.2 million tons in 1996 has shown an increase of 100 percent.

Chemical fertilizers and pesticides by plants is absorbed and stored in the edible parts of plants. For example, after absorption of urea in plant, nitrate accumulates in it. This nitrate is a carcinogenic substance and cause neurological disorders and disruption of the endocrine system and immune system.

The effect of different 8 species of bacterium Azotobacter, on plant growth are known via ability of molecular nitrogen fixation, production of plant growth regulators such as Uxin, Gibberline and Sytokin and similar compounds and the secretion of substances into the environment surrounding the roots and seeds and also production of antifungal metabolites and soluble phosphorus in the soil. Also useful effects of inoculated with bacteria on grain

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yield, legume, oilseeds, vegetables and nutrition plants have been studied and reported by several researchers [8]. Biological fertilizers cause the economic sustainability of soil resources, production, long-term maintenance and prevent of environmental pollution. On the other hand, the quality of food is a product of biological fertilizers not only consumer satisfaction but also supply and guarantee their physical health (Poorhanife, 2010).

Fallah and Besharati [4] reported that in treatments of corn that PSB (phosphate solver bacteria) and the phosphate fertilizer used simultaneously, The statistical difference in forage yield at 5% level in control was not observed. But most of the forage yield was the use of bacteria.

Afshahi and et al., [1] studied the effect of two kinds of biologic fertilizes and two ways of planting on the yield of corn silage. The findings show that using biological fertilizer had significant effect on all measured parameters and most yield is belong to two rows planting treatment with Humax biological fertilizer.

Robitashev Singh et al., [13] have inoculated Corn seed with the Azotobacter crococom and by planting them in the field with not inoculated seeds as control in a two-year field experiment they observed different treatments about are used or non-use of nitrogen that yield and forage dry material, ratio of green leaves per plant and shoot phosphate levels have been increased by inoculation.

Field studies done by Kapulaik et al., [7] showed that by using different amount of nitrogen chemical fertilizer, inoculation with Azospirillum bacteria is affected vegetative and reproductive growth of corn and plant height. Fresh weight and dry matter production, the number of ears on each plant and grain yield increased. Ear yield in different treatments increased that it ranged from 8.3 to 16 percent. Also Hernandez et al., [6] observed that inoculation with Pseudomonas Florescense and their plant under different treatments, the use of Urea in field causes increasing in plant height, shoot weight and number of leaves.

Nanda et al., [9] done field experiment and observed that inoculation with Azotobacter and Azosperillum bacteria cause increasing in forage yield in treatment of various amount of Nitrogen fertilizer.

Charla et al., [2] done a two year field experiment and observed that inoculation with Azotobacter and Azosperillum bacteria cause increasing in forage yield, grain yield, the amount of grain protein and its digestibility.

Diner and Stancheva, [3] reported that interaction between the system of corn roots and Azospirillum brasilense cause increasing in Biomass and nitrogen levels on plant.

Stephan et al., [14] Nitrogen fixation by Azoprilium Lipofereum and Azospirillum Brazilense species measured mgN/gr inoculum 9.4 and 8.8 respectively and observed that Azospirillum Lipofereum in comparison with Azospirillum brasilense has more synergy with the corn root.

Also Pandy et al., [10] observed significant increases in nitrogen and phosphorus in different parts of the plant and grain inoculated with Azospirillum Brazilense bacteria. Also, Vadivel et al., [15] reported an increased uptake of NPK and dry weight of seed inoculated with Azospirillum bacteria.

In a research, Purcino et al., [12] inoculated 6 types of corn seed with an inoculum containing different types of Azospirillum bacteria and cultured them in plots where there was 60 and 180 kg/ha pure nitrogen as urea. They observed of bacterial inoculation and Increase in consumption of urea, amount of leaves Nitrogen after 10 days After topping out and in harvest and 1,5 bi phosphate carboxylate enzyme, Protein solution, phosphonol piraot carboxylate enzyme activity, ferodexyme glutomat siklaz enzyme activity and yield increases.

Materials And Methods

This test was done in Farm Seed and Plant Improvement Institute which is located in Mohammad Shahr road With geographical coordinates 49 degrees north latitude and 51 degrees eastern longitude in 2008-2009 and 2009-2010 crop year.

According to climate, by ambrotermic means, due to 150 to 180 and sometimes 200 drought days, the region classified among the hot and dry mediterranean region. With a warm, wet winters and hot and dry summers, it is classified in semi-arid regions. The average annual rainfall is 240.6 mm, mainly in late autumn and early spring. The rainfall is in August and September with 1 mm and its maximum in may with an average rate 57 mm. Average annual maximum temperature in July is 35 degrees Celsius and average annual minimum temperature in January is -2.8 degrees celsius. The average air temperature in a 30-year period has been of 12.5 degrees celsius, so it classified in termic region. Also, annual rate of change of area is 791.8 mm. This region has a height of 1321 meters above sea level. Soil organic matter and nitrogen in the experiment is too low, it has moderate phosphor and relatively high potassium and aoil profile is based on Table 1.

An experiment was conducted in experimental field of agricultural research center of Karaj, Iran 2009 and 2011. Experiment laid out as split plot factorial based on randomized complete block design with three replications. Main plots includes two irrigation treatments of 70 (I1), 120(I2) mm evaporation from class a pan. Sub plots were biological fertilizer and chemical fertilizer as factorial biological fertilizer consisting of nitroxin
(Azospirillium lipoferum, Azospirillium brasilens, Azotobacter chroococcum, Azotobacter agilis \(10^8\) CFU ml\(^{-1}\)) (B\(_1\)), super nitro plus (Azospirillium spp., + Pseudomonas fluorescenc + Bacillus subtilis \(10^8\) CFU ml\(^{-1}\) + biological fungicide) (B\(_2\)), biophosphorus (Pseudomonas spp + Bacillus spp \(10^7\) CFU ml\(^{-1}\)) (B\(_3\)), and chemical fertilizer consisting of \(\text{N}_\text{20P}_\text{20K}_\text{20}\) (C\(_1\)), \(\text{N}_\text{50P}_\text{50K}_\text{50}\) (C\(_2\)), and \(\text{N}_\text{oPoKo}\) (C\(_3\)). Biological fertilizer were used as maize seed treatments. Seed of maize (KSC – 704) were Surface – sterilized with 0.02% Sodium hypochlorite for 2min, and rinsed thoroughly in sterile distilled water. For inoculation seeds rolled into the biological fertilizers. Nitroxin and biophosphorus used 1 lit and super nitro plus uses 2 lit per 30kg seeds.

**Table 1: Soil Characterize**

<table>
<thead>
<tr>
<th>Element</th>
<th>Value 1</th>
<th>Value 2</th>
<th>Value 3</th>
<th>Value 4</th>
<th>Value 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zn (mg/kg)</td>
<td>0.65</td>
<td>0.9</td>
<td>11.8</td>
<td>3.1</td>
<td>156</td>
</tr>
<tr>
<td>Cu (mg/kg)</td>
<td>0.65</td>
<td>42</td>
<td>33</td>
<td>23</td>
<td>7.5 - 8</td>
</tr>
<tr>
<td>Mg (mg/kg)</td>
<td>4.22</td>
<td>8</td>
<td>23</td>
<td>33</td>
<td>14.57</td>
</tr>
<tr>
<td>Fe (mg/kg)</td>
<td>0.65</td>
<td>23</td>
<td>14.57</td>
<td>156</td>
<td>3.1</td>
</tr>
<tr>
<td>N (ppm)</td>
<td>14.57</td>
<td>156</td>
<td>3.1</td>
<td>11.8</td>
<td>0.9</td>
</tr>
<tr>
<td>P (ppm)</td>
<td>0.65</td>
<td>42</td>
<td>33</td>
<td>23</td>
<td>7.5 - 8</td>
</tr>
<tr>
<td>K (ppm)</td>
<td>4.22</td>
<td>8</td>
<td>23</td>
<td>33</td>
<td>7.5 - 8</td>
</tr>
<tr>
<td>Soil texture</td>
<td>Loam</td>
<td>Loam</td>
<td>Loam</td>
<td>Loam</td>
<td>Loam</td>
</tr>
</tbody>
</table>

For measurement of Nitrogen we use kajeldal and for other elements we used Spectrophotometer and Electrophoresis. For data Analysis we used MSTATC software. we compared the averages based on DUNCAN test.

**Results and Discussion**

**Nitrogen of forage:**

**Irrigation:**

Irrigation treatments showed significant difference at 1% (Table 2), so under stress conditions (irrigation based on evaporation of 120 mm), compared with normal irrigation, 19.45 percent reduction in nitrogen content of forage was shown.

**Biological Fertilizer:**

These treatments also showed significant differences at 1% level (Table 3). As the nitrogen content of the forage nitroxin treatments, super nitroplus and bio phosphorus compared with the case without using biological fertilizer, the use of biological fertilizers, respectively, 25.02 and 24.15 and 11.48 percent increase.

**Chemical fertilizer:**

Chemical fertilizer treatments also showed significant differences at 1% level (Table 4), moreover, with increased use of fertilizer, nitrogen content of forage also increased. The results showed that the lack of use of fertilizer and Use 50 percent of the recommended fertilizer treatment compared to 100 percent of the recommended fertilizer respectively 31.16,7.46 percent decreased.

**Interaction between irrigation and biological fertilizer:**

These effects did not show significant difference between treatments (Table 5). The results showed that compared with control (normal irrigation and the use of biological fertilizers), sever stress conditions (of 120 mm evaporation pan of class A) and lack of using biological fertilizer, shows 24.46 percent reduction in nitrogen content, while using nitroxin, super nitroplus and bio phosphorus this difference is low, and compared to control, forage nitrogen content reduced 1.62, 0.31 and 11.16 percent respectively.

**Interaction between chemical fertilizer and biological fertilizer:**

These effects did not show significant difference between treatments (Table 6). But the results showed that in treatment, in treatments with use of 50% chemical fertilizer and don’t use biological fertilizer, forage nitrogen content compared with control (use 100 percent of the chemical fertilizer and lack of biological fertilizer) 12.52 percent decrease. But, with the use of nitroxin, super nitroplus and bio phosphorus in this treatment, forage nitrogen content compared with control increase 12.79, 10.09 and 3.8 percent respectively. The results of this experiment is consistent with results reported by Afsahi et al, [1], Stephen et al, [14], Pandy et al, [10], Purcino et al, [12] and Vadivel et al, [15].

**Phosphorus of forage:**

**Irrigation:**

The result of variance analysis showed that irrigation treatments were significant at 1% level on the amount of phosphorus concentration in shoot plant leaves normal treatments (70 mm evaporation pan of class A) has 16.73 percent more phosphorus stored in plant shoot compared with stress treatment (120 mm evaporation pan of class A) (Table 2).

**Biological fertilizers:**

Effects of biological fertilizer on treatments showed significant difference at 1% level (Table 3). Most concentration of phosphorus in the shoot were achieved of the biological fertilizer biophosphorus 0.519gr/kg. In control treatment, (not treated
biological fertilizers consider) biophosphorus biological fertilizers, super nitroplus and nitoxin have 55.85, 36.63 and 34.23 percent more phosphorus in shoot organs respectively.

**Chemical fertilizers:**

The results showed that the use of different amounts of chemical fertilizer treatments have significant difference at 1% level and more use of chemical fertilizers cause concentration of phosphorus in the shoot organs. With compared 100% use of recommended chemical fertilizers in the region, treatments with using 50% chemical fertilizer and not treated chemical fertilizer have 14.88 and 24.20 percent less phosphorus respectively (Table 4).

**Interaction Between Irrigation And Biological Fertilizer:**

These effects showed significant differences at 5% level (Table 5). The highest concentration of phosphorus in the shoot organs were achieved of normal irrigation with biophosphorus fertilizer and Lowest related to irrigation treatment of 120 mm evaporation without the use of biological fertilizer. In normal irrigation and non-use of biological fertilizer, 21.44 percent reduce in phosphorus in shoot organs was shown. Application of nitoxin, supernitroplus and biophosphorus fertilizers under stress condition compared with control, 12.6, 12.33 and 20.1 percent have more phosphorus in shoot organs respectively. This showed that biological fertilizers, especially biophosphorus fertilizer has has more influence on the concentration of phosphorus.

**Interaction Between Biological Fertilizer And Chemical Fertilizer:**

The effect of the 5% level between treatments showed significant differences (Table 6). The highest concentration of phosphorus in the shoot treatments related to the treatments using 100% of the recommended fertilizer with biological fertilizer biophosphorus and lowest was without using of both chemical and biological fertilizers. Results showed that in treatments with 50% of the recommended chemical fertilizer with nitoxin, supernitroplus and biophosphorus biological fertilizers compared with use 100% of the chemical fertilizer treatments and non-use of biological fertilizers 9.95, 1.24 and 36.06 percent increased in phosphorus in shoot was seen. In treatments without using chemical fertilizer, using biophosphorus biological fertilizer compared with control, showed 8.2 percent increased and using other fertilizers showed decreased. The results of this experiment is consistent with results reported by Fallah and besharati, [4], Pandy et al, [10], Robitashev singh et al, [13] and Vadivel et al, [15].

**Table 2: The effect of irrigation**

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Forages nitrogen (g/kg)</th>
<th>Forages phosphorus (g/kg)</th>
<th>Forages potassium (g/kg)</th>
<th>Forages protein (%)</th>
<th>Forages yield (t/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Irrigation (70mm)</td>
<td>7.077 a</td>
<td>0.482 a</td>
<td>14.174 a</td>
<td>9.320 a</td>
<td>73.883 a</td>
</tr>
<tr>
<td>Irrigation (120mm)</td>
<td>5.700 b</td>
<td>0.395 b</td>
<td>12.608 b</td>
<td>7.922 b</td>
<td>59.966 b</td>
</tr>
</tbody>
</table>

**Table 3: The effect of Biological Fertilizer**

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Forages nitrogen (g/kg)</th>
<th>Forages phosphorus (g/kg)</th>
<th>Forages potassium (g/kg)</th>
<th>Forages protein (%)</th>
<th>Forages yield (t/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitoxin</td>
<td>6.935 a</td>
<td>0.447 b</td>
<td>13.733 a</td>
<td>9.185 a</td>
<td>66.602 b</td>
</tr>
<tr>
<td>Super nitro plus</td>
<td>6.887 a</td>
<td>0.455 b</td>
<td>13.761 a</td>
<td>9.096 a</td>
<td>74.628 a</td>
</tr>
<tr>
<td>Biophosphor</td>
<td>6.184 ab</td>
<td>0.519 a</td>
<td>13.560 a</td>
<td>8.406 b</td>
<td>65.889 c</td>
</tr>
<tr>
<td>No Biological Fertilizer</td>
<td>5.547 b</td>
<td>0.333 c</td>
<td>13.510 b</td>
<td>7.797 c</td>
<td>60.570 d</td>
</tr>
</tbody>
</table>

**Table 4: The effect of Chemical Fertilizer**

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Forages nitrogen (g/kg)</th>
<th>Forages phosphorus (g/kg)</th>
<th>Forages potassium (g/kg)</th>
<th>Forages protein (%)</th>
<th>Forages yield (t/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>N100P100K100</td>
<td>7.332 a</td>
<td>0.504 a</td>
<td>13.908 a</td>
<td>9.561 a</td>
<td>70.961 a</td>
</tr>
<tr>
<td>N50P50K50</td>
<td>6.785 b</td>
<td>0.429 b</td>
<td>13.406 b</td>
<td>9.035 b</td>
<td>65.972 b</td>
</tr>
<tr>
<td>N0P0K0</td>
<td>5.047 c</td>
<td>0.382 c</td>
<td>12.589 c</td>
<td>7.266 c</td>
<td>63.840 c</td>
</tr>
</tbody>
</table>

**Potassium of forage:**

**Irrigation:**

Results showed that, at 1% level significant differences can be seen in irrigation treatments(Table 2). In treatments under stress condition (irrigation with 120mm evaporation), Potassium concentration in the shoot compared with normal irrigation treatment (70mm evaporation) decrease 11.04 percent .

**Biological fertilizer:**

Effect Biological fertilizer on treatments at 1% level showed significant differences(Table 3). And it was seen in treatments without using nitoxin, supernitro plus and biophosphorus fertilizers. 9.77,
10 and 8.39 percent increase in potassium concentration in the shoot.

**Chemical fertilizers:**

Results showed that chemical fertilizer in 1% level has significant differences (Table 4). With less using of chemical fertilizers, concentration of potassium in shoot decreased.

**Interaction Between Irrigation And Biological Fertilizer:**

Results showed that, the interaction in treatments at 1% level has significant differences (Table 5). The stress treatment and non-use of biological fertilizer compared with normal irrigation and non-use of biological fertilizer 15.4% decrease in potassium concentration in shoot was seen. But in this treatment with nitroxin, supernitroplus and biophosphorus compared with control, 3.87, 2.68 and 5.95 percent decrease in potassium concentration in shoot is seen respectively. This showed that biological fertilizer can partly compensate the effects of water shortages.

**Interaction Between Chemical And Biological Fertilizer:**

Results showed that, this interaction of treatments in 1% level has significant differences (Table 6), in treatments with 50% chemical fertilizer with nitroxin, supernitroplus and biophosphorus biological fertilizer compared with 100% use of recommended chemical fertilizers in the region and non-use of biological fertilizer have 7.04, 8.02 and 5.9% percent increase in potassium concentration in the shoot respectively. In conditions without using chemical fertilizer and with nitroxin, super nitroplus and biophosphorus biological fertilizer compared with 100% use of recommended chemical fertilizers in the region and non-use of biological fertilizer, we have 5% decrease in potassium concentration in the shoot. The results of this experiment is consistent with results reported by Pandy et al, [10], and Vadivel et al, [15].

**Protein of forage:**

**Irrigation:**

Irrigation effects on treatment at 1% level was significant (Table 2). As, forage yield in stress condition (120mm evaporation) compared with normal irrigation (70mm evaporation), 18.83% reduced.

**Biological fertilizer:**

Biological fertilizer has significant differences at 1% level (Table 3). Using nitroxin, supernitroplus and biophosphorus compared with non-use of biological fertilizer 17.8, 16.66 and 7.81 percent increase in protein concentration was seen.

**Chemical fertilizer:**

Biological fertilizer has significant differences at 1% level (Table 4). Most forage protein was obtained in 100 percent of the recommended fertilizer and least of that related to non-use chemical fertilizer treatment.

**Interaction Between Irrigation And Biological Fertilizer:**

These effects have not significant differences (Table 5). Use of biological fertilizer compared with normal irrigation with non-use of biological fertilizer increased forage protein.

**Interaction Between Chemical And Biological Fertilizer:**

This interaction doesn’t significant differences (Table 6). Using biological fertilizer with chemical fertilizer increase protein in seeds, but it is not significant. The results of this experiment is consistent with results reported by Mirkovacki and Milic, [8] and Charla et al, [2].

**Forage yield:**

**Irrigation:**

Irrigation effects on treatment at 1% level was significant (Table 2). As, forage yield in stress condition (120mm evaporation) compared with normal irrigation (70mm evaporation), 18.83% reduced.

**Biological fertilizer:**

Biological fertilizer effect on forage yield at 1% level showed significant differences (Table 3). Using nitroxin, supernitroplus and biophosphorus compared with non-use of biological fertilizer, 8.32, 28.31 and 10.4 percent increased. The results of this experiment is consistent with results reported by Afshahi et al, [1], Charla et al, [2], Nanda et al, [9], Hernandez et al, [6], Kapulaik et al, [7] and Robitashev singh et al, [13].

**Chemical fertilizer:**
Chemical fertilizer has significant differences at 1% level (Table 4). Most forage yield was obtained in 100 percent of the recommended fertilizer and least of that related to non-use chemical fertilizer treatment.

Interaction Between Irrigation And Biological Fertilizer:

Results showed that, the interaction in treatments at 1% level has significant differences (Table 5). The normal irrigation treatment and non-use of biological fertilizer compared with stress irrigation and non-use of biological fertilizer 16.68% decrease in forage yield was seen. But in stress treatment with nitroxin, supernitroplus and biophosphorus compared with control, 9.64, 7.81 and 11.96 percent decrease in forage yield is seen respectively.

Interaction Between Chemical And Biological Fertilizer:

Results showed that, the interaction in treatments at 1% level has significant differences (Table 6). The 100 percent of the recommended fertilizer treatment and non-use of biological fertilizer compared with 50 percent of the recommended fertilizer with nitroxin, supernitroplus and biophosphorus, 8.32, 28.31 and 10.4 percent decrease in forage yield was seen. The results of this experiment is consistent with results reported by Afsahi et al., [1], Fallah and Besharati, [4], Mirkovacki and Milic, [8], Charla et al., [2], Nanda, [9] and Robitashev singh, [13].

Table 5: The interaction effects irrigation and biological fertilizers

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Forages nitrogen (g/kg)</th>
<th>Forages phosphorus (g/kg)</th>
<th>Forages potassium (g/kg)</th>
<th>Forages protein (%)</th>
<th>Forages yield (t/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I1B1</td>
<td>7.653 a</td>
<td>0.473 b</td>
<td>14.437 a</td>
<td>9.903 a</td>
<td>76.168 a</td>
</tr>
<tr>
<td>I1B2</td>
<td>7.474 a</td>
<td>0.490 b</td>
<td>14.331 a</td>
<td>9.697 a</td>
<td>76.540 a</td>
</tr>
<tr>
<td>I1B3</td>
<td>6.860 a</td>
<td>0.589 a</td>
<td>14.373 a</td>
<td>9.110 a</td>
<td>76.076 a</td>
</tr>
<tr>
<td>I1B4</td>
<td>6.320 a</td>
<td>0.373 d</td>
<td>13.554 b</td>
<td>8.570 a</td>
<td>72.715 b</td>
</tr>
<tr>
<td>I2B1</td>
<td>6.217 a</td>
<td>0.420 cd</td>
<td>13.029 c</td>
<td>8.467 a</td>
<td>65.702 d</td>
</tr>
<tr>
<td>I2B2</td>
<td>6.300 a</td>
<td>0.419 cd</td>
<td>13.190 c</td>
<td>8.494 a</td>
<td>67.035 c</td>
</tr>
<tr>
<td>I2B3</td>
<td>5.508 a</td>
<td>0.448 bc</td>
<td>12.747 d</td>
<td>7.702 a</td>
<td>64.018 e</td>
</tr>
<tr>
<td>I2B4</td>
<td>4.774 a</td>
<td>0.293 e</td>
<td>11.466 e</td>
<td>7.023 a</td>
<td>60.586 f</td>
</tr>
</tbody>
</table>

Table 6: The interaction effects chemical fertilizers and biological fertilizers

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Forages nitrogen (g/kg)</th>
<th>Forages phosphorus (g/kg)</th>
<th>Forages potassium (g/kg)</th>
<th>Forages protein (%)</th>
<th>Forages yield (t/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>B1C1</td>
<td>7.944 a</td>
<td>0.522 a</td>
<td>14.447 a</td>
<td>10.195 a</td>
<td>68.365 d</td>
</tr>
<tr>
<td>B1C2</td>
<td>7.530 a</td>
<td>0.442 b</td>
<td>13.672 d</td>
<td>9.780 a</td>
<td>65.509 f</td>
</tr>
<tr>
<td>B1C3</td>
<td>5.331 a</td>
<td>0.377 cd</td>
<td>13.080 e</td>
<td>7.580 e</td>
<td>64.296 g</td>
</tr>
<tr>
<td>B2C1</td>
<td>7.855 a</td>
<td>0.517 a</td>
<td>14.353 ab</td>
<td>10.105 a</td>
<td>77.597 a</td>
</tr>
<tr>
<td>B2C2</td>
<td>7.350 a</td>
<td>0.407 bc</td>
<td>13.797 ed</td>
<td>9.600 ab</td>
<td>75.322 b</td>
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References


