Impact of Humic acid on the Morphology and Yield of Wheat (*Triticum aestivum* L.)

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**Abstract:** Different studies reveal the effects of humic substances on plant growth and yield. Humic acid consistently show positive effects on plant biomass. It also Stimulate the growth of root and shoot. The root growth is generally more apparent than stimulation of shoot growth. In this study the wheat growth and yield was observed and by the application of humic acid all the attributes show significant and positive results. By the increase of humic acid conc. the root, shoot and yield production was increased. It was concluded that application of humic acid in the soils is a good source to increase soil fertility.

**Key words:** Humic Acid - Morphology - Wheat - Yield - Impact - UOG

**INTRODUCTION**

Wheat (*Triticum aestivum* L.) is one of the vital cereals. More than one third population of the world depends upon wheat as a staple food crop. It lies on the top of all cereal crops in term of calories and protein supply [1]. In Pakistan, wheat is a vital staple food amongst main food crops. In the overall grain production wheat adds about 74% and its share is 30% of the value installed by main crops [2]. Wheat belongs to Poaceae family and globally after maize wheat is the second most produced food among the cereal crops, rice ranks third. High substrate salinity is a major limiting factor for plants in coastal habitats that germination being one of the most critical periods in life cycle of halophytes [3, 4]. The natural organic matter of soil, peats and water consists of a mixture of plant and animal products in different stages of decomposition together with substances synthesized biologically and chemically. This organic matter is usually divided into two groups: non-humic substances and humic substances. The non-Humics include a large number of relatively simple compounds of known structures belonging to well-known groups: hydro carbohydrates, proteins, peptides, amino acids, fats, waxes, resins, pigments and other low molecular weight organic substances. These compounds are easily attacked by microorganisms and have a relatively short survival rate so that the bulk of organic matter consists of humic substances [5]. Soil organic matter mainly consists of Humic and fulvic acids which are called humin materials [6]. Humic substances are major components of organic matter, often constituting 60 to 70% of the total organic matter [7]. Humic substances (HS) are recognized as a key component of soil fertility properties, since they control chemical and biological properties of the rhizosphere [8, 9].

Gadimov, *et al.* [10] claimed that Humic substances are natural technological products with a miraculous biological effect on crops and concluded that a scientific and practical program is required to make use of this technology in the world, particularly in developing countries. In many studies, Humic and fulvic acid preparations were reported to increase the uptake of mineral elements [11-13] to promote the root length [14, 15] and to increase the fresh and dry weights of crop plants [16-18]. Turkmen, *et al.* [19] showed that humic acid application in soil increased tomato yield. Humic acid is also significantly positive effective in leaf chlorophyll content. Ayas and Gulser [20] reported that humic acid leads to increased growth and height and subsequently increased biological yield through increasing nitrogen content of the plant. It has also been reported that application of humic acid in nutritional solution led to increased content of nitrogen within aerial parts and growth of shoots and root of maize [21]. The mechanism of Humic acid activity in promoting plant growth is not
completely known, but several explanations have been proposed by some researchers such as increasing cell membrane permeability, oxygen uptake, respiration and photosynthesis, phosphate uptake and root cell elongation [22, 19]. When adequate humic substances are present within the soil, the requirement for nitrogen, phosphorus and potassium fertilizer applications may be reduced [23].

**MATERIALS AND METHODS**

This study was conducted to assess the effect of Humic Acid on morphology and Yield characteristics of wheat. The experiment was conducted in the growing season of wheat in 2012. Variety of wheat (*Triticum aestivum* L.) used for this experiment was Faisalabad 2008 obtained from Punjab seed corporation.

**Field Area:** The field area selected for the experiment is situated in Sialkot. Sialkot is a city situated in the northeast of the Punjab province in Pakistan at the foothills of the snow-covered peaks of Jammu & Kashmir near the Chenab River. Lying between 32°30' North latitude and 74°31’ East longitude at an altitude of 256 m above sea level.

**Climate of Sialkot:** Sialkot features a humid subtropical climate under the Koppen climate classification. Sialkot is chilly during winters and hot and humid during summers. May and June are the hottest months and temperature raise to 45°C. The temperature during winter may drop to 0°C in December and January. The land is generally, plain and fertile and best for wheat growth.

**Layout of Field:** The seeds were sown at farmer’s field in Sialkot. The each plot length was 90 Feet and width was 20 Feet (Fig. 2).

**Treatments:** The five treatments and two replicates for each treatment were used for experiment.

- T0= 0 Kg humic acid /ha (Control)
- T1= 5Kg humic acid /ha
- T2= 7.5Kg humic acid /ha
- T3= 10Kg humic acid /ha
- T4= 12.5Kg humic acid /ha

The above mentioned doses were applied at completion of tillering stage followed by irrigation. Humic acid was applied by broadcasting method. Seeds were sown manually with hand drill. The seed rate was 125 Kg/ha, N.P.K fertilizer was applied according to departmental recommendation (128-114-62 Kg/ha). Irrigation, weed control methodology and all other agronomic practice were kept same for all the treatments. After the growth, 10 plants from each treatment were uprooted randomly and means of following parameters were observed.

![Geographical position of Sialkot](image-url)
Fig. 2: Layout of the Plots. Plot Size = 20 × 90 = 1800 Feet (167.31m²)
Date of Sowing: 28-11-2012 (Temperature = 15°C, Average Humidity level = 68)
Date of Application of Humic Acid: 10-1-2013 (Temperature = 11°C, Average Humidity level = 77)
Date of Harvest: 15-5-2013 (Temperature = 35°C, Average Humidity level = 25)

Root, Shoot and Spike length (cm): The root length was measured from base to the tip of the longest root. Shoot length was measured from the base of the shoot to the youngest leaf. As well as spike length was measured. These measurements were done with the help of scale.

Yield: Following parameters related to yield were recorded and counted:

- Number of spikelet’s/spike.
- Number of Grains/spike.
- Weight of 100 Grains.

Plant Biomass (g): To measure the plant biomass the plants were uprooted from the soil carefully and then washed with distilled water and separated into roots and shoot, after that these plants roots, shoots and leaves were dried in oven at 65°C for one week and dry weight (g) was recorded.

Statistical Analysis: Randomized Complete Block Design (analysis of variance technique) of the data was computed for all attributes by using COSTAT for DOS computer program version 3.03. Bar graph values were drawn by using Microsoft Excel software.

RESULTS AND DISCUSSIONS

Root Length and Spike Length: By the application of Humic acid the plant growth was positively affected as the treatments were increased the plant shoot roots and length was also increased and the maximum growth was observed in T4 (12.5Kg HA/ha) of both attributes. The shoot length of T4 plants was 88.95 cm and the root length was 15.67 cm. (Fig: 3 a, b). The ANOVA table also show the Significant result about root length. (Table: 1). In the growth of Spikes the similar results with root and shoot length were obtained the maximum growth was noted in Treatment 4 (12.5Kg HA/ha) i.e. 10.07 cm. Many researchers concluded the enhancing effect of humic acid on growth and yield and nutrient uptake by many crops [24-27]. Humic acids have been reported to enhance mineral nutrient uptake by plants, by increasing the permeability of membranes of the root cells [28]. Tattini, et al., [29] reported that nitrogen uptake rate by the roots of container grown olive plants increased after application of humic acid concentrations in the range of 30–120 mg/pot, with the greater humic acid concentrations decreasing nitrogen uptake. Moreover, the positive influences of humic acids on plant growth and productivity, which seem to be concentration specific, could be mainly due to hormone like activities of the humic acids through their involvement in cell respiration, photosynthesis, oxidative phosphorylation, protein synthesis and various enzymatic reactions [30-34].

Yield: The number of spikelets were also affected by humic acid treatments the maximum number of spikelets was observed in T4 (Fig. 3: d) which ultimately increased the Number of grains (Fig. 3: e). In this way weight of 100 grains was increased in highest treatment value. All the yield readings were significant as shown in ANOVA table: 1. Muharrem, et al., [35] pointed that foliar spray of humic acid substances at 3 to 6 leaf stage significantly increased yield and yield components in common bean. Wang, et al., [36] found increase in wheat yield by the use of humic acid in alkaline soils.

Dry Biomass: The root, shoot and leaf lengths were increased by the humic acid application which in turn increased the Dry biomass of root, shoot and leaf. In the case of dry root weight there was constant increased in weight as shown in Fig.3: g. The root growth and weight was more apparent as compared to shoot growth and weight. There was sudden increase of dry shoot weight as compared to dry root weight. Chen and Aviad [31] also reported that the effects of humic substances on plants are often greater on roots than on shoots. Stimulation of root growth, increased proliferation of root hairs and enhancement of root initiation by humic acids has
Fig. 3: Effect of Humic Acid on Plant Length (a), Root Length (b), Spike Length (c), No. of Spikelet’s (d), No. of Grains (e), Weight of 100 Grains (f), Dry Root Weight (g), Dry Shoot Weight (h) and Dry Leaf Weight (i) of Wheat (Triticum aestivum L.).

Table 1: Means of analysis of variance for Plant Length, Root Length, Spike Length, No. of Spikelet’s, No. of Grains, Weight of 100 Grains, Dry Root Weight, Dry Shoot Weight and Dry Leaf Weight by the application of Humic Acid on Wheat (Triticum aestivum L.).

<table>
<thead>
<tr>
<th>Source</th>
<th>MS of Plant Length (cm)</th>
<th>MS of Root Length (cm)</th>
<th>MS of Spike Length (cm)</th>
<th>MS of No. of Spikelet’s</th>
<th>MS of No. of Grains</th>
<th>MS of Weight of 100 Grains (g)</th>
<th>MS of Dry Root Weight (g)</th>
<th>MS of Dry Shoot Weight (g)</th>
<th>MS of Dry Leaf Weight (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Humic Acid</td>
<td>0.566ns</td>
<td>0.35**</td>
<td>0.23**</td>
<td>0.89ns</td>
<td>1.14**</td>
<td>0.39***</td>
<td>0.10***</td>
<td>0.79***</td>
<td>0.25***</td>
</tr>
<tr>
<td>Error</td>
<td>0.133</td>
<td>0.27</td>
<td>0.13</td>
<td>0.44</td>
<td>0.092</td>
<td>2.5</td>
<td>0.003</td>
<td>0.0032</td>
<td>0.004</td>
</tr>
<tr>
<td>Total</td>
<td>9</td>
<td></td>
<td></td>
<td></td>
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Df= Degree of Freedom, ns= non-significant, *, **, *** significant at 0.05, 0.01 and 0.001 levels respectively.

been reported commonly by several other researchers [37, 38, 31, 29]. The increased root and leaf dry weight, root diameter, root length as well as leaf fresh weight and leaf crude proteins in forage turnip [39]. The mechanism by which humic acid stimulate plant growth are not fully clear, although there are some theories which probably work together. It is well established that HA have beneficial physical, biological and chemical effects on soils and many researchers have demonstrated that these effects can increase plant growth. Other mechanisms which have been suggested to account for promotion of plant growth by humic substances include: enhanced uptake of metallic ions and increases in cell permeability [31].

REFERENCES


