RESPONSE OF ONION (*Allium cepa*) GROWTH AND YIELD TO DIFFERENT LEVELS OF NITROGEN AND ZINC IN SWAT VALLEY

Arshad Ali Khan*, Muhammad Zubair*, Abdul Bari** and Fazal Maula**

ABSTRACT
The response of onion (*Allium cepa*) growth and yield to different levels of nitrogen and zinc in Swat valley was studied at Agricultural Research Station (North) Mingora Swat, during 2003-04. Nitrogen levels under trail were 0, 100 and 200 kg per hectare, while zinc levels were 0, 5, 10 and 15 kg per hectare. The statistical analysis revealed that both nitrogen and zinc significantly affected all the growth parameters studied. Maximum leaf length (41.81 cm), was recorded in plots fertilized with 100 kg nitrogen and 10 kg zinc per hectare, whereas maximum plant height (56.33 cm), bulb weight (136.5 g), yield (22280 kg) per hectare were recorded in plots fertilized with 100 kg nitrogen per hectare and zinc 10 kg per hectare.

Keywords: *Allium cepa*, Mingora, Nitrogen, Onion, Pakistan, Yield, Zinc

INTRODUCTION
Onion (*Allium cepa*) belongs to the family Amaryllidaceous and is one of the most important monocotyledonous, cross-pollinated and cool season vegetable crops. Onion has its own distinctive flavor and is used in soups, meat dishes, salads, and Sandwiches, and is cooked alone as a vegetable. Its pungency is due to the presence of a volatile oil (allyl propyl disulphide) (Malik 1994).

A pound of onion contain Protein 6 g, Fats 0.9 g, Carbohydrate 44 g, Calcium 137 mg, Phosphorous 188 mg, Iron 2.1 mg, Thiamine 0.15mg, Riboflavin 0.1 mg, Niacin 0.6mg and Ascorbic acid 38 mg. (Thomson and Kelly 1982)

Liberal application of nitrogen fertilizer can stimulate plant growth and increase zinc requirements beyond the available supply. The amount and properties of nitrogen source and its placement in relation to the zinc fertilizer has a notable effect on zinc availability. Nitrogen fertilizers that are acid forming will increase the uptake of both native and supplemental zinc. On the other hand, products with a neutral to basic effect are known to depress zinc uptake (Tisdale et al. 1985).

Being a high yielding crop, onion utilizes large quantities of the nutrients from the soil, but onion per hectare yield is still low in Pakistan as compared to other countries. The best way to improve the yield and growth is to apply appropriate amount of fertilizer. Nitrogen, being a component of amino acids and chlorophyll, promotes rapid vegetative growth, protein content and yield of the crop. Therefore, keeping in mind the above-mentioned facts, the present experiment was carried out to find out the most suitable dose of nitrogen and zinc fertilizers for onion cultivars, in order to obtain better and higher yield and growth under the agro-climatic conditions of the Swat valley.

MATERIALS AND METHODS
An experiment entitled "Response of onion (*Allium cepa*) growth and yield to different levels of nitrogen and zinc in Swat valley" was conducted during 2003-04 at Agricultural Research Station (North) Mingora Swat, with a view to find the most suitable doses of nitrogen and zinc and their interaction. Nursery of the onion cultivar swat-1 was transplanted in a well-prepared field on 8th February 2004. The experimental plot was ploughed and disked several times, and well-rotten farm yard manure was incorporated into the soil well-ahead of the transplantation. Before fertilizer application soil samples were taken randomly from the area demarcated for the experiment and the soil was analyzed for nitrogen, phosphorous, potash, zinc, PH and organic matter. It revealed that the specific field contained 0.018 kg N; 11.91 kg P; 112.5 kg K; 1.35 kg Zinc; 0.37 kg Organic matters where as PH of the soil was 5.9.

The source of fertilizer for nitrogen, phosphorous, potash and zinc were Urea, Di-ammonium Phosphate (DAP), Sulphate of Potash (SOP) and Zinc Sulphate and all the fertilizers were applied by broadcast method. Nitrogen was applied in two split doses. First dose was applied before transplantation, while the second dose was applied 30 days after transplantation. Zinc was applied as a whole before transplantation. Hoeing and weeding operation were carried out after germination, depend upon the intensity of weeds and crust problems. The crop was irrigated regularly. In case of diseases like late blight and insect attack for trips, different chemicals (karate, mancozeb, rodomil etc) control measures were adopted. The experimental plants were regularly observed and the data were recorded on the leaf length, plant...
height, weight and total yield. The experiment was laid out in Randomized Complete Block Design (RCBD) having 12 treatments with 4 replications.

P (P2O5) was applied at the rate of 180.55 g per plot whereas K (K2O) at the rate of 166.66 g per plot. Nitrogen (N) was applied at rates 0, 174 and 348 g per plot which comes to 0, 100 and 200 kg per hectare whereas Zn was applied at rates 0, 17, 35 and 52 g per plot which comes to 0, 5, 10 and 15 kg per hectare.

RESULTS AND DISCUSSION
The experimental results are briefly discussed in the following paragraphs.

Leaf length (cm)
From the review of the results in Table-I it is evident that nitrogen and zinc levels both significantly affected leaf length. Maximum leaf length (41.81 cm) was observed in plots applied with nitrogen at the rate of 100 kg per hectare; while minimum leaf length (38.32 cm) was recorded in plots received no nitrogen (control). The reason for this may be that leaf length is a vegetative character and different nitrogen levels significantly affect vegetative characters. Therefore, leaf length was significantly increased with increasing nitrogen levels from 0 to 100 kg/ha. The results of Singh and Chuare (1999) are of importance who reported that nitrogen application up to 150 kg per ha increase leaf length as compared to that obtained in control plots.

The results also revealed that different zinc levels significantly affected the leaf length. Plots fertilized with 10 kg Zn/ha produced maximum leaf length (42.31 cm) while minimum leaf length (38.16 cm) was recorded in plots received no zinc (control). It is because of the fact that zinc involves in auxin metabolism that increases leaf length. These results are in agreement with those of Tisdale et al. (1985) who reported that zinc is involved in auxin metabolism and other enzymatic reactions increase leaf length.

According to the interaction different nitrogen and zinc levels significantly affected the leaf length. Leaf length was maximum (47.13 cm) in plots received 100 kg N/ha and Zinc 10 kg/ha, while minimum leaf length (36.45 cm) was recorded in plots received neither nitrogen nor zinc. It may be due to collective effect of nitrogen and zinc that stimulate plant growth and thus increases leaf length.

Plant height (cm)
Results regarding plant height are presented in Table-II. The nitrogen and zinc levels both significantly affected the plant height. The results revealed that maximum plant height (50.15 cm) was noted in plots applied with nitrogen at the rate of 100 kg per hectare while minimum plant height (45.82 cm) was recorded in plots received no nitrogen (control). These results are in close conformity with the findings of Singh et al. (1994) who observed that 80 kg N/ha gave the tallest plants.

According to the results different zinc levels also significantly affected plant height. Maximum plant height (50.51 cm) was obtained from the plots fertilized with Zinc at the rate of 10 kg/ha, whereas minimum plant height of (44.63 cm) was obtained in control plots with 0 kg Zn/ha. The results of Tisdale et al. (1985) are of primary importance in this regard, who reported that zinc deficiency cause shortening of the stem or stalk and stunted growth.

Interaction of N and Zn also indicate that 100 kg N and 10 kg Zn was the best to produce Pl. height of 56.33 cm.

Bulb weight (gm)
According to the results in Table-III, the nitrogen and zinc levels had significant effect on bulb weight. Maximum bulb weight (119.8 gm) was observed in plots applied with nitrogen at the rate of 100 kg per hectare; while minimum bulb weight (98.81 gm) was recorded in plots received no nitrogen (control). This may be due the fact that nitrogen supply to the plant increases the rate of metabolism; more carbohydrate is synthesized and thus increases bulb weight. In support of these finding, Amin et al. (1995) reported that 100 kg/ha nitrogen resulted in maximum bulb weight.

Based on the results different zinc levels significantly affected individual bulb weight. Application of 10 kg Zn/ha produced maximum bulb weight (113.7 gm), whereas minimum bulb weight (99.50 gm) was noted in plots received no zinc (control). These results are in agreement with those of Meena and Singh (1998) who reported that Zn significantly increased dry weight of the bulb.

The significantly highest bulb weight could be the collective effect of N and Zinc as evident from interaction, where 100 kg N and 10 kg Zn at the rate of 10 kg/ha produced maximum bulb weight.

Yield (kg/ha)
From the review of the results in Table-IV it is evident that nitrogen and zinc levels both significantly affected the total yield. Maximum yield (17800 kg) per hectare was obtained in plots fertilized with nitrogen at the rate of 100 kg per ha.
hectare; while minimum yield (10460 kg) per hectare was recorded in plots received no nitrogen (control). This may be due to the fact that nitrogen supply to the plant increases the rate of metabolism where more carbohydrate is synthesized which increases the bulb weight and thus increases total yield. The results of Amin et al. (1995) are of primary importance in this regard who reported that 100 kg N/ha resulted in maximum yield. The results are also in conformity with Sadaria et al. (1997) who reported that the yield was highest with 100 kg nitrogen per hectare.

Different zinc levels also showed significant effect with respect to yield kg per hectare. Maximum yield (16760 kg) per plot was obtained from the plots fertilized with zinc at the rate of 10 kg/ha; whereas minimum yield (11600 kg) per hectare was obtained from plots received no zinc (control). The results are in conformity with those of Mukesh et al. (1997) who reported that the high fresh onion yield was achieved on plots treated only with zinc at 10 kg Zn/ha. The results of Sliman et al. (1999) and Mukesh et al. (2000) are also in close conformity in this regard.

Since the highest bulb weight the collective effect of N and Zn at rate of 100 kg and 10 kg respectively. This is projected in yield per hectare.

CONCLUSION AND RECOMMENDATIONS
It is recommended that combine application of nitrogen and zinc at the rate of 100 kg and 10 kg per hectare is the most suitable dose for maximum growth and yield of onions.

Table-I:  Leaf length (cm) as affected by different levels of nitrogen and zinc

<table>
<thead>
<tr>
<th>Nitrogen (kg ha⁻¹)</th>
<th>Zinc kg ha⁻¹</th>
<th>0</th>
<th>5</th>
<th>10</th>
<th>15</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td>36.45</td>
<td>38.45</td>
<td>38.90</td>
<td>39.50</td>
<td>38.32</td>
</tr>
<tr>
<td>100</td>
<td></td>
<td>36.70</td>
<td>39.57</td>
<td>47.12</td>
<td>43.85</td>
<td>41.81</td>
</tr>
<tr>
<td>200</td>
<td></td>
<td>41.35</td>
<td>42.80</td>
<td>41.92</td>
<td>40.10</td>
<td>41.54</td>
</tr>
<tr>
<td>Mean</td>
<td></td>
<td>38.16</td>
<td>40.27</td>
<td>42.31</td>
<td>41.15</td>
<td></td>
</tr>
</tbody>
</table>

LSD value for Nitrogen at alpha 0.01 = 3.036, LSD value for Zinc at alpha 0.05 = 2.61, LSD value for interaction at alpha 0.05 = 4.52.
Means not followed by the same letters are significantly different.

Table-II:  Plant height (cm) as affected by different levels of nitrogen and zinc

<table>
<thead>
<tr>
<th>Nitrogen (kg ha⁻¹)</th>
<th>Zinc kg ha⁻¹</th>
<th>0</th>
<th>5</th>
<th>10</th>
<th>15</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td>42.75</td>
<td>45.80</td>
<td>46.50</td>
<td>48.22</td>
<td>45.82</td>
</tr>
<tr>
<td>100</td>
<td></td>
<td>45.65</td>
<td>49.22</td>
<td>56.33</td>
<td>49.40</td>
<td>50.15</td>
</tr>
<tr>
<td>200</td>
<td></td>
<td>45.50</td>
<td>49.05</td>
<td>48.70</td>
<td>49.30</td>
<td>48.14</td>
</tr>
<tr>
<td>Mean</td>
<td></td>
<td>44.63</td>
<td>48.03</td>
<td>50.51</td>
<td>48.97</td>
<td></td>
</tr>
</tbody>
</table>

LSD value for Nitrogen at alpha 0.01 = 2.57, LSD value for Zinc at alpha 0.01 = 2.97, LSD value for interaction at alpha 0.05 = 3.83.
Means not followed by the same letters are significantly different.

Table-III:  Bulb weight (gm) as affected by different levels of nitrogen and zinc

<table>
<thead>
<tr>
<th>Nitrogen (kg ha⁻¹)</th>
<th>Zinc kg ha⁻¹</th>
<th>0</th>
<th>5</th>
<th>10</th>
<th>15</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td>93.50</td>
<td>100.50</td>
<td>100.30</td>
<td>101.00</td>
<td>98.81</td>
</tr>
<tr>
<td>100</td>
<td></td>
<td>103</td>
<td>109.5</td>
<td>136.5</td>
<td>130</td>
<td>119.8</td>
</tr>
<tr>
<td>200</td>
<td></td>
<td>102</td>
<td>104.8</td>
<td>104.3</td>
<td>103.8</td>
<td>103.7</td>
</tr>
<tr>
<td>Mean</td>
<td></td>
<td>99.50</td>
<td>104.9</td>
<td>113.7</td>
<td>111.6</td>
<td></td>
</tr>
</tbody>
</table>

LSD value for Nitrogen at alpha 0.01 = 3.036, LSD value for Zinc at alpha 0.05 = 2.61, LSD value for interaction at alpha 0.05 = 4.52.
Means not followed by the same letters are significantly different.
LSD value for Nitrogen at alpha 0.01 = 9.82, LSD value for Zinc at alpha 0.01 = 11.34, LSD value for interaction at alpha 0.05 = 24.62.

Means not followed by the same letters are significantly different.

**Table-IV:** Yield kg per hectare as affected by different levels of nitrogen and zinc

<table>
<thead>
<tr>
<th>Nitrogen kg per hectare</th>
<th>Zinc kg per hectare</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>0</td>
<td>8969 e</td>
<td>11720 de</td>
</tr>
<tr>
<td>100</td>
<td>12440 de</td>
<td>18530 b</td>
</tr>
<tr>
<td>200</td>
<td>13410 cd</td>
<td>13840 cd</td>
</tr>
</tbody>
</table>

Mean 11600 B 14700 A 16760 A 14510 A

LSD value for Nitrogen at alpha 0.01 = 2429, LSD value for Zinc at alpha 0.01 = 2805, LSD value for interaction at alpha 0.05 = 3616.

**REFERENCES**


