EFFECT OF HOMOBRASSINOLIDE SEED TREATMENT ON GERMINATION, α AMYLASE ACTIVITY AND YIELD OF WHEAT UNDER MOISTURE STRESS CONDITION

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Received on 25 August, 1995, Revised on 21 August, 1996

SUMMARY

Homobrassinolide application as seed treatment (0.01 and 0.05 ppm) resulted in increased germination, α amylase activity and total soluble protein in 48h old seedlings and shoot length in 96 h old seedlings both with and without PEG-6000 induced moisture-stress. The data indicate that homobrassinolide may affect enzyme activity as well as protein synthesis resulting in higher seedling growth. In the field grown crop, homobrassinolide treatment under irrigated and rainfed condition resulted in significant increase in seed yield. The increase in seed yield was associated with increase in ear number per plant, grain number per ear, 1000 grains weight and harvest index.

INTRODUCTION

Seed germination is one of the serious problem affecting crop stand and ultimately productivity in arid regions under rainfed condition. Various techniques have been suggested to improve the seed germination ranging from simple seed soaking with water (Aschermann-Koch et al., 1992) to treatment with GA (Lecat et al., 1992) and fungicide (Scudamore and Goodship, 1992). Recently a new class of endogenous phytohormones, brassinosteroids, have been identified. It is reported to have beneficial effect on seed germination (Chang and Cai, 1988), α amylase activity (Dong et al. 1989), growth (Kim and Sa, 1989), photosynthesis and translocation (Braun and Wild, 1984), yield (Kumura et al. 1989, and Ikekwa and Zhao, 1991) and membrane stability and stress tolerance (Schilling et al., 1991). Since so many beneficial effects have been attributed to them, an experiment was planned to study the effect of seed treatment with homobrassinolide, a brassinostroid, on seed germination and yield in field under irrigated and rainfed conditions.

MATERIALS AND METHODS

An experiment was conducted in the winter season to study the efficacy of homobrassinolide seed treatment under laboratory and field conditions. Seeds of wheat (Triticum aestivum L.) cv. HD 2329 having similar size and weight were surface sterilized with 0.1% mercuric chloride and subsequently washed thoroughly with distilled water. Seed treatment was given by soaking the seeds in 0.01 and 0.05 ppm homobrassinolide (HBR) solution for 6h. Control seeds were soaked in distilled water for the same duration. Fifty seeds were placed in each petridish lined with whatman filter paper No. 1. One set of 10×3 petridishes was moistened with distilled water, while second and third sets were provided with polyethylene glycol (PEG)-6000 solutions to create stress of -5 and -10 bars of water potential, respectively and allowed to germinate at 25°C in the dark. Emergence of the radicle was used as an indicator of germination. Per cent germination, α amylase activity in the germinated seeds and soluble protein were estimated after 48h and shoot length was estimated after 96h of soaking.

The activity of α amylase was estimated following the method of Shuster and Gifford, (1962), Enzyme activity was expressed as mg of starch hydrolyzed per min per 10 seeds. Soluble protein content were estimated according to the method of Lowry et al. (1951).
Homobrassinolide treated and control (untreated) seeds were also sown in the field. In the field sowing was done in rows 25 cm apart at a uniform seed rate of 100 kg per ha in plots measuring 3.0 m × 2.5 m under irrigated and rainfed conditions. Recommended fertilizers and other interculture operations were carried out as and when required. Yield and yield attributing parameters were recorded at the time of harvest. The experiment was laid down in randomized block design and all data was statistically analyzed for analysis of variance.

RESULTS AND DISCUSSION

Results on seed germination and α amylose activity of seedlings (Fig. 1 and 2) shows significant decrease in germination percentage and α amylose activity of seedlings at -10 bars moisture-stress. Homobrassinolide (HBR) treatment at both levels (0.01 and 0.05 ppm) significantly improved germination and α amylose activity in 48h old seedlings, the maximum effect was observed at 0.05 ppm level. Improvement in germination by brassinolide under irrigated and stress condition has also been reported by other workers (Chang and Cai, 1988 and Dong et al., 1989). The results shows that HBR not only increase germination and seedling growth but also help in stress tolerance as is clear from increased germination and α amylose activity of seedlings at -10 bar moisture stress as compared to untreated seeds. Dong et al. (1989) has also reported increased germination, α amylose activity and cold resistance by brassinolide treatment in rice seedlings. Moisture stress significantly decreased the soluble protein content of germinating seeds. HBR treatment increased soluble protein content under stressed and control conditions (Fig 3). Thus it seems that the increase in α amylose activity in HBR treated seedlings could be due to more enzyme protein synthesis as Kalinich et al. (1985) and Mandava et al. (1987) have also reported increased nucleic acid and protein synthesis due to brassinosteroid application.

Results on shoot length (Fig. 4) shows that though stress at both levels (-5 and -10 bars) reduced shoot length, HBR 0.05 ppm significantly increased shoot length in control as well as in stressed seedlings. Beneficial effect of brassinosteroids on shoot length have also been reported by various workers (Shen et al., 1988 and Sasse, 1990).

The long term effect of improved seedling growth by treating the seeds with HBR was observed in field. HBR treatment increased yield under irrigated and stressed conditions. The increase in grain yield by HBR (0.05 ppm) under irrigated and rainfed conditions was 25 and 41% respectively (Table 1). The seed yield was primarily due to increase in number of ears per plant, grain number per ear, grain weight and harvest index. Beneficial effect of

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Ears/m row</th>
<th>Grains/e</th>
<th>1000 grains weight (g)</th>
<th>Biomass/m row (g)</th>
<th>Harvest index</th>
<th>Grain yield/m row (g)</th>
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</thead>
<tbody>
<tr>
<td><strong>Irrigated</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>102.3</td>
<td>57.3</td>
<td>43.23</td>
<td>1015.8</td>
<td>46.60</td>
<td>441.7</td>
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<tr>
<td>HBR 0.01 ppm</td>
<td>114.3</td>
<td>65.1</td>
<td>44.93</td>
<td>1149.2</td>
<td>49.03</td>
<td>563.8</td>
</tr>
<tr>
<td>HBR 0.05 ppm</td>
<td>118.0</td>
<td>67.2</td>
<td>46.53</td>
<td>1091.0</td>
<td>50.83</td>
<td>554.0</td>
</tr>
<tr>
<td><strong>Rainfed</strong></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>75.0</td>
<td>50.6</td>
<td>39.13</td>
<td>677.3</td>
<td>38.03</td>
<td>257.5</td>
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<tr>
<td>HBR 0.01 ppm</td>
<td>95.7</td>
<td>53.3</td>
<td>40.57</td>
<td>723.5</td>
<td>40.53</td>
<td>293.2</td>
</tr>
<tr>
<td>HBR 0.05 ppm</td>
<td>98.0</td>
<td>57.1</td>
<td>41.93</td>
<td>856.5</td>
<td>42.43</td>
<td>363.3</td>
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<td>LSD (P=0.05)</td>
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<tr>
<td>Stress</td>
<td>3.00</td>
<td>0.88</td>
<td>0.23</td>
<td>14.1</td>
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<td>HBR</td>
<td>3.65</td>
<td>1.08</td>
<td>0.29</td>
<td>17.3</td>
<td>0.30</td>
<td>3.9</td>
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<tr>
<td>Stress X HBR</td>
<td>NS</td>
<td>NS</td>
<td>24.4</td>
<td>NS</td>
<td>5.6</td>
<td></td>
</tr>
</tbody>
</table>

Table I: Effect of homobrassinolide seed treatment on grain yield and yield attributing parameters of wheat under irrigated and rainfed conditions in field.
brassinosteroids on biomass (Schilling et al., 1991), grain weight (Fujii et al. 1991) and grain yield (Hirai et al. 1991) has also been reported.

A perusal of the results shows that HBR not only promote germination, enzyme activity, seedling growth and yield but also induces stress tolerance in the plant as is evident from its ameliorating effect under -10 bars moisture-stress as well as under rainfed condition on crop yield in field grown crop. These results are in accordance with the findings of other workers who have reported water stress tolerance (Shen et al., 1990 and Schilling et al., 1991) cold-stress tolerance (Hirai et al., 1991) and heat-stress tolerance (Kulaeva et al. 1991) due to brassinosteroid treatment. Thus it can be concluded that the initial effect of HBR seed treatment results in increased vigour and growth of seedlings which might cause healthier crop growth as well as add resistance to withstand the stress which ultimately results in higher yield in plots sown with treated seeds.

ACKNOWLEDGEMENT

Authors are grateful to M/s Godrej Soaps Ltd. Bombay for supplying the sample of homobrassinolide for this study.

REFERENCES


