Crop geometry and weed management effect on weed dynamics in soybean

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Soybean (Glycine Max. L. Merrill.) grown in rainy season faces severe weed competition. Weed competition in soybean at early stage of crop growth is critical, as it causes yield losses up to 35 to 50% (Tiwari and Kurchania 1990). The incessant rains do not permit timely inter-cultivations and manual control of weeds on account of high cost and labour shortage during need of weeding. There is a need for alternative methods for reducing the weed load during crop weed competition period of first 30-45 days. Therefore, present investigation was conducted to see the effect of crop geometry and weed management practices on growth and yield of soybean.

Experiment was conducted at Mahatma Phule Krishi Vidyapeeth, Rahuri, Ahmednagar (Maharashtra) during Kharif (rainy) season, 2015. The experiment was laid out in factorial randomized block design consisted of two factors, first crop geometry, viz. 45 x 5 and 30 x 10 cm and second factor was weed management practices viz. pendimethalin as pre-emergence (PE) 0.75 kg/ha/fb one hand weeding at 30 DAS (days after sowing), pendimethalin as PE 0.75 kg/ha/fb tank mix imazethapyr + propaquizafop (80 + 60 g/ha) at 25 DAS, one hoeing at 15 DAS fb hand weeding at 30 DAS, weedy check and weed free check. The soybean variety used was ‘KDS-344’ (Phule Agrani). The gross and net plot size were 6.0 x 5.4 and 5.6 x 4.5 m, respectively. The soil of experimental site was silty clay in texture, medium in available nitrogen (204 kg/ha), phosphorous (18 kg/ha) and very high in potassium (548 kg/ha) with pH of 8.18 and electrical conductivity of 0.16 ds/m. The recommended fertilizer dose (75:50:00 N, P₂O₅ and K₂O kg/ha) was applied as basal through urea and single super phosphate at the time of sowing. Growth and yield parameters of soybean crop, total weed density (no./m²), weed dry matter (g/m²) were periodically recorded by following standard methodology. Weed control efficiency (%), weed index (%), herbicide efficiency index (%) and crop resistance index (%) were calculated by using standard. The herbicide pendimethalin 38.7% CS was used as pre-emergence while imazethapyr 10% SL, propaquizafop 10% EC were applied as post-emergence by using 500 litre spray volume through knapsack spray pump fitted with flat fan nozzle.

Weed density and biomass

Crop geometry of 45 x 5 cm spacing recorded significantly lowest total weed density (3.55, 3.21 and 3.22 (no./m²) at 28, 56 DAS and at harvest, respectively) as compared to 30 x 10 cm spacing (Table 1). This might be due to wider rows and closer plants hence significantly reduced weed population because increased competition from higher density of crop plants resulted in suppression of weeds. These results were in close conformity with the finding of Bishnoi and Mays (2002). Among the weed management practices, pendimethalin PE 0.75 kg/ha/fb tank mix imazethapyr + propaquizafop (80 + 60 g/ha) at 25 DAS recorded significantly lowest weed density while pendimethalin PE 0.75 kg/ha/fb one hand weeding at 30 DAS recorded lowest weed density at 56 DAS and at harvest. This might be due to application of pre-emergence herbicide, which effectively hindered the germination of weed seeds while application of post-emergence tank mix imazethapyr + propaquizafop (80 + 60 g/ha) at 25 DAS or hand weeding at 30 DAS effectively controlled latter emerged weeds. These results were in close conformity with Jadhav et al. (2013).

Soybean dibbled at geometry of 45 x 5 cm recorded significantly the lowest weed dry matter at harvest (5.28 g/m²) as compared to 30 x 10 cm spacing (Table 1). It might be due to increased competition from higher density of crop plants resulted in reducing weed density and thereby reduced biomass of weed (g/m²). These results were

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in close conformity with the finding of Bishnoi and Mays (2002). Among the weed management treatments, pendimethalin PE 0.75 kg/ha fb one hand weeding at 30 DAS registered significantly lowest weed biomass at harvest (4.04 g/m²) as compared to the rest of the treatments.

**Weed control efficiency**

Crop geometry 45 x 5 cm spacing recorded significantly higher weed control efficiency (74%) at harvest as compared to 30 x 10 cm spacing. Pendimethalin 0.75 kg/ha fb one hand weeding at 30 DAS and pendimethalin 0.75 kg/ha fb tank mix application of imazethapyr + propaquizafop (80 + 60 g/ha) at 25 DAS recorded highest weed control efficiency of 89 and 88%, respectively at harvest (Table 1).

**Weed index and herbicide efficiency index**

Crop geometry of 45 x 5 cm spacing recorded numerically lowest weed index (11.7%) and highest herbicide efficiency index value (1.3) as compared to 30 x 10 cm spacing (12.1 and 0.5, respectively). This might be due to less crop-weed competition during the growing period of the crop resulted in better yield. Among the weed management practices the growing period of the crop resulted in better yield. These results are close conformity with the finding of Nainwal et al. (2010).

**Crop resistance index**

Crop geometry of 45 x 5 cm spacing recorded significantly highest crop resistance index value (9.6) as compared to 30 x 10 cm spacing (6.7). Among the integrated weed management treatments, pendimethalin 0.75 kg/ha fb one hand weeding at 30 DAS recorded significantly highest crop resistance index (15.2) followed by the pendimethalin 0.750 kg/ha fb tank mix imazethapyr + propaquizafop (80 + 60 g/ha) at 25 DAS (12.9) (Table 1).

**Grain and straw yield**

Crop geometry of 45 x 5 cm recorded significantly highest soybean grain yield (2.08 t/ha) and straw yield (2.85 t/ha) as compared to 30 x 10 cm spacing (1.83 t/ha) and (2.23 t/ha), respectively (Table 2). Results suggested that in wider spacing, lowest weed competition due to suppression of weeds and more interception of sun light by crop increased photosynthetic activities resulted in better

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**Table 1. Effect of crop geometry and weed management practices on weed dynamics**

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Total weed count (no./m²)</th>
<th>Weeds dry matter (g/m²) at harvest</th>
<th>WCE (%)</th>
<th>Weed index at harvest</th>
<th>Herbicide efficiency index at harvest</th>
<th>Crop resistance index at harvest</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>28 DAS</td>
<td>56 DAS At harvest</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Crop geometry</strong></td>
<td></td>
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</tr>
<tr>
<td>30 x 10 cm</td>
<td>3.76 (20.06)</td>
<td>3.45 (17.79)</td>
<td>3.46 (17.99)</td>
<td>5.63 (49.91)</td>
<td>71.08 (49.91)</td>
<td>12.1 (0.53)</td>
</tr>
<tr>
<td>45 x 5 cm</td>
<td>3.55 (18.65)</td>
<td>3.21 (16.38)</td>
<td>3.22 (16.59)</td>
<td>5.28 (46.25)</td>
<td>73.85 (46.25)</td>
<td>11.6 (1.27)</td>
</tr>
<tr>
<td>LSD (p=0.05)</td>
<td>0.15</td>
<td>0.19</td>
<td>0.19</td>
<td>0.07</td>
<td>0.58</td>
<td>NS</td>
</tr>
<tr>
<td><strong>Weed management</strong></td>
<td></td>
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</tr>
<tr>
<td>Pendimethalin PE 0.75 kg/ha fb one hand weeding at 30 DAS</td>
<td>3.89 (14.66)</td>
<td>2.44 (5.49)</td>
<td>2.44 (5.49)</td>
<td>4.04 (15.85)</td>
<td>89.42 (15.85)</td>
<td>3.9 (2.04)</td>
</tr>
<tr>
<td>Pendimethalin PE 0.75 kg/ha fb tank mix imazethapyr + propaquizafop (80 + 60 g/ha) at 25 DAS</td>
<td>1.67 (2.33)</td>
<td>2.59 (6.32)</td>
<td>2.59 (6.32)</td>
<td>4.39 (18.88)</td>
<td>87.69 (18.88)</td>
<td>4.0 (1.43)</td>
</tr>
<tr>
<td>One hoeing at 15 DAS fb hand weeding at 30 DAS</td>
<td>3.96 (15.32)</td>
<td>2.74 (7.15)</td>
<td>2.74 (7.15)</td>
<td>4.47 (19.60)</td>
<td>85.21 (19.60)</td>
<td>9.0 (1.03)</td>
</tr>
<tr>
<td>Weedy check</td>
<td>8.06 (64.48)</td>
<td>8.18 (66.48)</td>
<td>8.24 (67.48)</td>
<td>13.66 (186.1)</td>
<td>0.00 (186.1)</td>
<td>42.7 (0.00)</td>
</tr>
<tr>
<td>Weed free check</td>
<td>0.71 (0.0)</td>
<td>0.71 (0.0)</td>
<td>0.71 (0.0)</td>
<td>100.0 (0.0)</td>
<td>0.00 (0.0)</td>
<td>0.0 (0.0)</td>
</tr>
<tr>
<td>LSD (p=0.05)</td>
<td>0.24</td>
<td>0.30</td>
<td>0.30</td>
<td>0.10</td>
<td>0.92</td>
<td>1.9 (0.01)</td>
</tr>
</tbody>
</table>

Original values are in parentheses transformed to $\sqrt{X + 0.5}$; PE= Pre-emergence
utilization of nutrients, light, moisture and space by soybean crop for growth and development which reflected its effect into reproductive growth of soybean crop in terms of yield. These results are close conformity with the findings of Pandya et al. (2005). Weed free check treatment recorded significantly highest soybean grain yield (2.2 t/ha) and straw yield (2.7 t/ha), but it was at par with pendimethalin 0.75 kg/ha fb one hand weeding at 30 DAS (2.2 t/ha) and (2.7 t/ha), respectively. These results were in close conformity with the findings Habimana et al. (2013).

Economics

Crop geometry 45 x 5 cm spacing recorded highest net monetary returns (₹ 38205/ha) and B:C Ratio (1.96) as compared to 30 × 10 cm crop geometry (₹ 30411/ha) and (1.81), respectively (Table 2). This might be due to higher grain and straw yield. Pendimethalin 0.75 kg/ha fb one hand weeding at 30 DAS (2.2 t/ha) and (2.7 t/ha), respectively. These results were in close conformity with the findings Sankaranarayanan (2002).

It was concluded that geometry of 45 x 5 cm spacing as well as both weed management practices, viz. pendimethalin PE 0.75 kg/ha fb one hand weeding at 30 DAS and pendimethalin PE 0.75 kg/ha fb tank mix imazethapyr + propaquizafop (80 + 60 g/ha) at 25 DAS recorded significantly lowest total weed count, weed dry matter and weed index while higher WCE, herbicide efficiency index, crop resistance index and higher soybean grain, straw yield, net returns and B:C ratio.

REFERENCES


