Herbicides Application Alone and in Combination with Urea for Control of Weeds in Wheat

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Abstract
Five substituted area based herbicides namely Isoproturon (Arelon 500 FW), Isoproturon + Diflufenican (Panther 520 FW) isoproturon + Bromoxynil + MCPA (Doublet 48 FW), Chlortoluron + MCPA (Agmol combi 60 WP) and Isoproturon (Miron 75 WP) applied @ 2.5 1, 2.0 1, 2.5 1, 2.5 kg and 1.25 kg ha\(^{-1}\), respectively, controlled, 87.2 to 90.8 per cent weeds in wheat and caused 10.29 to 15.98 per cent increase in grain yield over weedy check. These herbicides, when applied with 3 per cent urea solution, gave 92.6 to 95 per cent weed control and 19.24 to 25.47 per cent increase in grain yield over weedy check.

Introduction
Use of herbicides for the control of a variety of broad and narrow-leaved weeds is gaining popularity in Pakistan. Among the various factors influencing the absorption of post-emergence herbicides the leaf surface is critical. Surface of leaf is covered with wax-like cuticle. This cuticle acts as barrier against intimate contact between the sprayed herbicides and the leaf surface by repelling water. Consequently, penetration of a herbicide into cellular targets is reduced. Use of nitrogenous solution, acting as adjuvants, may enhance toxicity, assist emulsification, increase spreading properties, promote leaf absorption, penetration, retention and effective action of herbicides (Anderson, 1977 and Bayer et al., 1982). Bhan (1987) found that in the field heavily infested with Phalaris minor along with broad leaved weeds, a combination of substituted urea herbicides with 3 per cent urea solution proved better in controlling weeds and gave maximum grain yield than sole application of herbicides. Three isoproturon formulations namely Arelon, Tolkan and Miron each @ 1 kg ha\(^{-1}\) were equally effective for control of Phalaris minor, when applied 35 days after the sowing. The yields obtained were 5.53, 5.99 and 5.66 t ha\(^{-1}\), respectively as compared to 3.62 t ha\(^{-1}\) of weedy check (Punia et al., 1989).

Singh et al., (1989) found that isoproturon applied @ 1 kg ha\(^{-1}\) as post-emergence controlled almost all the annual monocotyledonous and dicotyledonous weeds. Varsheney and Singh (1990) reported 82 per cent reduction in weed dry matter when a mixture of urea and isoproturon @ 0.5 and 0.75 kg ha\(^{-1}\) was sprayed to the field of wheat.

Subhan and Khan (1991) recorded 90 per cent control of *Avena fatua, Fumaria officinalis, Phalaris minor* and *Vicia sativa* with Dicuran MA-60 (Chlortoluron + MCPA) at 2.25 kg ha\(^{-1}\). Wheat yield increased as a result of herbicide treatment by 29-71 per cent above average weedy control levels of 2015 kg ha\(^{-1}\). Sharar et al., (1994) stated that Panther @ 2 1, Doublet @ 2.5 1, Tolkan @ 2 1, Agmol combi, @ 2.5 1, Miron @ 1.25 kg and Sencor @ 750 and 875 g ha\(^{-1}\) gave significantly maximum grain yield of 1.97, 1.64 and 1.60 t ha\(^{-1}\), respectively.

Keeping all these in view, present study was undertaken to see the comparative efficacy of urea-based herbicides applied alone and in combination with urea solution, as an adjuvant, to control weeds in wheat.

Materials and Methods
Field study to evaluate the effect of five post-emergence herbicides namely isoproturon (Arelon 500 FW) @ 2.5 1 ha\(^{-1}\), Isoproturon + Diflufenican (Panther 520 FW) @ 2 1 ha\(^{-1}\), Isoproturon + Bromoxynil + MCPA (Doublet 48 FW) @ 2.5 1 ha\(^{-1}\), Chlortoluron MCPA (Agmol combi 60 WP) @ 2.5 kg ha\(^{-1}\) and Isoproturon (Miron 75 WP) @ 1.25 kg ha\(^{-1}\) alone and in combination with 3 per cent urea solution against weedy check, on weeds and yield of wheat, was undertaken at the Agronomic Research Area, University of Agriculture, Faisalabad. Experiment was quadruplicated in randomized complete block design. Wheat variety “Pak-81” was sown with a single row hand drill in rows 30 cm apart in plots measuring 7 x 1.8 m. The herbicides were sprayed with a knapsack hand sprayer, fitted with specially made boom of 1.8 m in width, after the first irrigation in well moisture conditions. Observations on weed prevalence were recorded by counting the weed from randomly selected 1 m\(^{-2}\) area in each experimental unit three weeks after spraying herbicides. Number of fertile tillers was counted from 1 m\(^{-2}\) area and ten spikes were selected at random for counting the number of grains per spike. The data were analyses by using Fisher’s analysis of variance technique. Treatments means were compared by using Duncan’s New Multiple Range Test at 5 per cent probability (Steel and Torrie, 1984).

Results and Discussion
The common weeds found in the field were Phalaris minor, Rumex dentatus, Coronopus didymus, Convolvulus arvensis and Medicago denticulate. Phalaris minor was the most frequent weed. All the herbicides offered 87.2 - 90.8 per cent and 92.6 - 95.0 per cent control of broad and grass weeds up to 3 weeks when applied alone and with 3 per cent urea solution, respectively (Table 1). All the herbicides gave complete control of Rumex dentatus, Coronopus
Table 1: Weed population (m⁻²) and mortality per cent 3 weeks after spray

<table>
<thead>
<tr>
<th>Weed check</th>
<th>Total weeds</th>
<th>Mortality percent</th>
<th>Mortality</th>
<th>Broad leaved weeds</th>
<th>Total of broad leaved weeds</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>P.minor</td>
<td>M.denticulata</td>
</tr>
<tr>
<td>Isoproturon @ 2.5 1 ha⁻¹</td>
<td>51c</td>
<td>90</td>
<td>90.0</td>
<td>100.0</td>
<td>100</td>
</tr>
<tr>
<td>Isoproturon @ 2.5 1 ha⁻¹ + 3 % urea</td>
<td>37cde</td>
<td>92.6</td>
<td>91.7</td>
<td>100.0</td>
<td>100</td>
</tr>
<tr>
<td>Isoproturon + Diflufenican @ 2 1 ha⁻¹</td>
<td>46cd</td>
<td>90.8</td>
<td>92.9</td>
<td>98.9</td>
<td>100</td>
</tr>
<tr>
<td>Isoproturon + Diflufenican @ 2 1 ha⁻¹ + 3 % urea</td>
<td>35de</td>
<td>93.0</td>
<td>95.7</td>
<td>100.0</td>
<td>100</td>
</tr>
<tr>
<td>Isoproturon + Bromoxylin + MCPA @ 2.51 ha⁻¹</td>
<td>46cd</td>
<td>90.8</td>
<td>91.6</td>
<td>100.0</td>
<td>100</td>
</tr>
<tr>
<td>Isoproturon + Bromoxylin + MCPA @ 2.51 ha⁻¹ + 3 % urea</td>
<td>26e</td>
<td>94.8</td>
<td>96.4</td>
<td>99.0</td>
<td>100</td>
</tr>
<tr>
<td>Chlortoluron + MCPA @ 2.5 kg ha⁻¹</td>
<td>49cd</td>
<td>90.2</td>
<td>92.3</td>
<td>88.5</td>
<td>100</td>
</tr>
<tr>
<td>Chlortoluron + MCPA @ 2.5 kg ha⁻¹ + 3 % urea</td>
<td>30e</td>
<td>94.0</td>
<td>94.9</td>
<td>96.0</td>
<td>100</td>
</tr>
<tr>
<td>Isoproturon @ 1.25 kg ha⁻¹</td>
<td>64a</td>
<td>87.2</td>
<td>90.7</td>
<td>100.0</td>
<td>100</td>
</tr>
<tr>
<td>Isoproturon @ 1.25 kg ha⁻¹ + 3 % urea</td>
<td>25e</td>
<td>95.0</td>
<td>95.2</td>
<td>98.0</td>
<td>100</td>
</tr>
</tbody>
</table>

Means not sharing a letter in common differ significantly at 5 per cent probability level.

Table 2: Grain yield and yield components of wheat

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Fertile tillers (m⁻²)</th>
<th>No. of grains per</th>
<th>1000-grain weight (g)</th>
<th>Grain yield (q ha⁻¹)</th>
<th>Incidence of chipping</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weed check</td>
<td>341.3c</td>
<td>36.5d</td>
<td>40.6d</td>
<td>36.9c</td>
<td>11.0</td>
</tr>
<tr>
<td>Isoproturon @ 2.5 1 ha⁻¹</td>
<td>395.3b</td>
<td>41.5bc</td>
<td>42.2bcd</td>
<td>41.3cd</td>
<td>19.0</td>
</tr>
<tr>
<td>Isoproturon @ 2.5 1 ha⁻¹ + 3 % urea</td>
<td>415.3a</td>
<td>46.6a</td>
<td>45.3a</td>
<td>44.1abc</td>
<td>20.0</td>
</tr>
<tr>
<td>Isoproturon + Diflufenican @ 2 1 ha⁻¹</td>
<td>395.0b</td>
<td>41.6bc</td>
<td>42.8abcd</td>
<td>44.6abc</td>
<td>20.0</td>
</tr>
<tr>
<td>Isoproturon + Diflufenican @ 2 1 ha⁻¹ + 3 % urea</td>
<td>415.0a</td>
<td>45.7a</td>
<td>43.8abc</td>
<td>46.3a</td>
<td>25.0</td>
</tr>
<tr>
<td>Isoproturon + Bromoxylin + MCPA @ 2.5 1 ha⁻¹</td>
<td>401.0b</td>
<td>41.4bc</td>
<td>41.0cd</td>
<td>40.7d</td>
<td>10.0</td>
</tr>
<tr>
<td>Isoproturon + Bromoxylin + MCPA @ 2.5 1 ha⁻¹ + 3 % urea</td>
<td>420.0a</td>
<td>46.8a</td>
<td>44.1ab</td>
<td>44.0abc</td>
<td>19.0</td>
</tr>
<tr>
<td>Chlortoluron + MCPA @ 2.5 kg ha⁻¹</td>
<td>402.0b</td>
<td>41.3bc</td>
<td>41.5bcd</td>
<td>44.2abc</td>
<td>20.0</td>
</tr>
<tr>
<td>Chlortoluron + MCPA @ 2.5 kg ha⁻¹ + 3 % urea</td>
<td>420.0a</td>
<td>44.9ab</td>
<td>44.4ab</td>
<td>45.4ab</td>
<td>23.0</td>
</tr>
<tr>
<td>Isoproturon @ 1.25 kg ha⁻¹</td>
<td>400.7b</td>
<td>39.1cd</td>
<td>41.8bcd</td>
<td>42.8bcd</td>
<td>15.0</td>
</tr>
<tr>
<td>Isoproturon @ 1.25 kg ha⁻¹ + 3 % urea</td>
<td>418.3a</td>
<td>44.6ab</td>
<td>44.1ab</td>
<td>45.6ab</td>
<td>23.0</td>
</tr>
</tbody>
</table>

Means not sharing a letter in common differ significantly at 5 per cent probability level.
idymus and more than 88.5 per cent control of Medicago
enticulate. Convolvulus arvensis showed 100 per cent
control of Medicago denticulate. Convolvulus arvensis
showed 100 per cent survival against all the treatments.
Per cent weed control for four broad leaved weeds was in
the range of 92.0 to 97.0 (Table 1). As regards Phalaris
minor the respective figure for its per cent control ranged
from 90 -96.4. These results showed a better control of
weeds as compared to when these herbicides were applied
alone. These results are also supported by Bhan (1987) and
All the herbicides treated plots produced significantly more
number of fertile tillers, grains per spike and 1000-grain
weight than weedy check (Table 2). It is also clear that all
the herbicides varied considerably with one another in
aspect of above cited yield components. Moreover all the
herbicides with 3 per cent urea solution were statistically
similar to one another and produced relatively more fertile
tillers, grains per spike and 1000-grain weight.
Minimum number of fertile tillers, grains per spike and
1000-grain weight in weedy check could be attributed to
presence of weeds which competed with crop plant for
environmental resources. More number of yield components
in a herbicide and urea treated plots might have resulted from
greater growth and development of crop plants due to
addition of urea.

Here was a significant enhancement in grain yield of the
treated plots over the weedy check (Table 2). The
enhancement was in the range of 10.29 - 19.78 per cent
of herbicides applied alone and 19.24 - 25.47 per cent for
herbicides applied with 3 per cent urea solution. Higher
grain yield was resulted from more number of fertile tillers,
number of grains per spike and 1000-grain weight. The
increase in grain yield and yield components could be
attributed to better weeds control resulting in more uptake
of moisture, nutrients and the light harvest by the crop
plants. Punia et al. (1989) and Sharar et al. (1994) also
obtained a significant increase in grain yield over the weedy
check.

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