Effect of fluazifop and bentazon tank-mixed on weeds and selected legume crops.

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Keywords: Fluazifop — Bentazon — Tank-mixture — Antagonism — Injury — Stand — Reduction — Legume crops

Summary

Field trials were conducted in Dschang, Cameroon, during the dry season (1991) and the rainy season (1992) to evaluate weed control and crop susceptibility to fluazifop-P (250 g a.i/ha) and fluazifop-P (250 g a.i/ha) plus bentazon (750 g a.i/ha). Different legume crops included: peanuts, soybeans, cowpea, and common beans varieties white, red, marigue, multi-color and earth-color.

Plots treated with fluazifop resulted in 91 and 98% control of Setaria barbata and Cydonon dactylon, respectively. When tank-mixed with bentazon, fluazifop activity dropped to 38 and 88% for the control of S. barbata and C. dactylon, respectively. Broadleaf weeds (Mimosa pudica and Ageratum conyzoides) were more effectively controlled with the mixture of both herbicides.

Significant crop injury (22-67%) was observed during the dry season trial on all varieties with the herbicides combination. This resulted in significant stand reduction with the most susceptible crop being cowpea (52% stand reduction). Yield reduction was observed when cowpea was treated with fluazifop plus bentazon (74 kg/ha compared to 145 kg/ha for fluazifop used alone or 138.5 kg/ha for the control).

Résumé


Les parcelles traitées avec le fluazifop ont permis de contrôler le Sétaria barbata, et le Cydonon dactyon à 91 et 98% respectivement. Cependant, mélange à bentazon, l'activité du fluazifop a été réduite à 38% pour le S. barbata et 88% pour le C. dactylon. Toutefois, les dicotylédones (Mimosa pudica et Ageratum conyzoides) étaient mieux contrôlées avec le mélange d'herbicides.

Des dégâts importants (22 à 67%) étaient enregistrés pendant la saison sèche avec le mélange d'herbicides, le niébé étant la culture la plus sensible. Travaillé avec le mélange fluazifop et bentazon, le niébé a vu son rendement baisser de 138.5 kg/ha pour les parcelles non traitées à 47,0 kg/ha.

Introduction

A wide range of grain legumes are grown in tropical Africa for human consumption. These include common bean (Phaseolus vulgaris), cowpea (Vigna unguiculata), peanut (Arachis hypogaea) and the recently introduced soybean (Glycine max).

Legume crop yield is generally low in the tropics, due to weed infestation (1). All legumes need to be kept weed-free during the first 6 weeks following planting. This will generally require 2 weedings at 3 and 6 weeks (1). In Cameroon, hand weeding is a common practice used for weed control by small-scale producers. However, these techniques are very time consuming and can cause serious losses to crops such as peanut especially when glyphophytes are damaged.

In Cameroon, legume crops are grown in the rainy season, as components of the intercropping system. This makes chemical weed control difficult and can explain the sole use of cultural methods. During the dry season however, a double-crop legume production (especially common beans) in a pure culture is becoming very common. This double-crop production is therefore very appropriate for chemical weed control.

Major weeds in the Dschang area include broadleaves such as Mimosa pudica, Ageratum conyzoides and grasses such as Cydonon dactylon and Setaria barbata (3, 6). Adequate post-emergence control of these weed species requires a combination of a graminicide such as fluazifop-P and a broadleaf herbicide such as bentazon. However, bentazon injury has been reported on many crop cultivars, including soybean, cucumber (Cucumis sativus L.), pepper (Capsicum annuum L.) and sweet potato (Ipomea batatas L.) (2, 5, 8, 9, 10). The use of bentazon in many crop cultivars without preliminary testing is therefore very risky.

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Received on 19 11 92 and accepted for publication on 09 03 93.
This study was conducted to evaluate the activity of fluazifop-P and bentazon for post-emergence weed control in legumes, and to examine the susceptibility of these crops to tank-mixtures of both herbicides.

**Material and methods**

Field experiments were conducted during 1991 and 1992 in Dschang, Cameroon to evaluate the susceptibility of selected legume crops to post-emergence application of fluazifop-P and fluazifop-P plus bentazon, and to determine the activity of these herbicides on weeds under different climatic conditions. In 1991 (dry season trial from October to December), average temperature and rainfall were 20.5°C and 80 mm, respectively while in 1992 (rainy season trial from April to June) 21.2°C and 255 mm were recorded, respectively.

The experimental plot had a natural infestation of *Mimosa pudica*, *Ageratum conyzoides*, *Cynodon dactylon* and *Setaria barbata*. S. barbata and A. conyzoides infestations were very heavy (>100 plants/m²) while C. dactylon and M. pudica infestations were moderate (about 50 plants/m²) and somewhat uniform. Different legume crops were planted manually on October 15, 1991 and March 30, 1992 in 60 cm rows with one seed per 15 cm of row. Individual plots consisted of 6 rows of each crop and were 5 m long by 3.6 m wide.

The experiment was a 8 by 3 factorial (crop by herbicide) arranged in a randomized complete block design with four replications. The first factor included soybean, peanut, cowpea, and five local and stable varieties of common bean (White, Red, Maringe, Earth-color and Multi-color), identified according to the seed testa color. The second factor included the untreated control, fluazifop (250 g a.i/ha) and fluazifop (250 g a.i/ha) plus bentazon (750 g a.i/ha). All herbicide treatments were performed on November 27, 1991 and May 14, 1992 with a knapsack sprayer delivering 1000 l/ha through a flat fan spray tip.

Estimates of crop injury and weed control were made respectively 2 and 6 weeks after herbicide treatments, using Frans et al. (4) scale of 0% (no injury or control) to 100% (complete death of the plant) based on population density and plant vigor. Stand reduction was also recorded as the percentage of the number of plants initially present. For each crop, yield data were recorded at maturity (Table 2) by hand-harvesting all the 6 rows.

All data on weed control, crop injury, stand reduction and yield were subjected to analysis of variance, and means separated using Duncan's Multiple Range Test at 5% level of probability.

Results and discussions

In general, there was more weed infestation in the rainy season with the predominance of monocotyledonous species such as *Cynodon dactylon*, *Setaria barbata* and *Cyperus rotundus*. During the dry season, broadleaf weeds (*Mimosa pudica*, *Ageratum conyzoides* and *Gainsoga sp.*) were more prevalent. Because of low soil moisture, the different crops were less vigorous in the dry season, and resulted in high attacks of common beans by rust (*Uromyces phaseoli*) and peanut by viruses. In the rainy season however, cowpea was severely attacked by Ascochyta blight (*Ascochyta phaseolina*) and produced no seeds (Table 4).

<table>
<thead>
<tr>
<th>Weed species</th>
<th>Fluazifop + bentazon</th>
<th>Fluazifop</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Setaria barbata</em></td>
<td>38.0 b*</td>
<td>91.3 a</td>
<td>0 b</td>
</tr>
<tr>
<td><em>Cynodon dactylon</em></td>
<td>88.8 b</td>
<td>98.8 a</td>
<td>0 c</td>
</tr>
<tr>
<td><em>Mimosa pudica</em></td>
<td>66.4 a</td>
<td>0.0 b</td>
<td>0 b</td>
</tr>
<tr>
<td><em>Ageratum conyzoides</em></td>
<td>98.0 a</td>
<td>18.8 b</td>
<td>0 c</td>
</tr>
</tbody>
</table>

* Means within a row followed by the same letter did not differ significantly (at P=0.05) according to Duncan's Multiple Range Test.

**TABLE 2:**

<table>
<thead>
<tr>
<th>Crops</th>
<th>Number of days before harvesting</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>common beans</td>
<td>D (dry season)</td>
<td>F (rainy season)</td>
</tr>
<tr>
<td>White</td>
<td>123</td>
<td>92</td>
</tr>
<tr>
<td>Red</td>
<td>96</td>
<td>89</td>
</tr>
<tr>
<td>Maringe</td>
<td>118</td>
<td>86</td>
</tr>
<tr>
<td>Multi-color</td>
<td>107</td>
<td>98</td>
</tr>
<tr>
<td>Earth-color</td>
<td>103</td>
<td>86</td>
</tr>
<tr>
<td>cowpea</td>
<td>125</td>
<td>-a</td>
</tr>
<tr>
<td>soybean</td>
<td>123</td>
<td>-β</td>
</tr>
<tr>
<td>peanut</td>
<td>151</td>
<td>149</td>
</tr>
</tbody>
</table>

α Harvest not made because of disease attacks. β No growth.

**TABLE 3:**

<table>
<thead>
<tr>
<th>Crop</th>
<th>Fluazifop + bentazon</th>
<th>Fluazifop</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>common beans</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>184.5 a*</td>
<td>209.5 a</td>
<td>181.8 a</td>
</tr>
<tr>
<td>Red</td>
<td>163.3 a</td>
<td>210.0 a</td>
<td>275.0 a</td>
</tr>
<tr>
<td>Maringe</td>
<td>176.5 a</td>
<td>245.9 a</td>
<td>247.5 a</td>
</tr>
<tr>
<td>Multi-color</td>
<td>124.5 b</td>
<td>162.4 ab</td>
<td>191.2 a</td>
</tr>
<tr>
<td>Earth-color</td>
<td>163.5 a</td>
<td>163.6 a</td>
<td>208.0 a</td>
</tr>
<tr>
<td>cowpea</td>
<td>47.0 b</td>
<td>145.8 a</td>
<td>138.5 a</td>
</tr>
<tr>
<td>soybean</td>
<td>129.5 a</td>
<td>146.5 a</td>
<td>129.2 a</td>
</tr>
<tr>
<td>peanut</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
</tr>
</tbody>
</table>

*Means within a row followed by the same letter did not differ significantly (at P=0.05) according to Duncan's Multiple Range Test.

ND = Not determined.

Significant crop injury and stand reduction were observed in the dry season when fluazifop was applied in combination with bentazon (Figure 1 and 2). The most susceptible crop was cowpea with 67.5% injury and 52.5% stand reduction. This was followed by the common bean variety "Multi color" with 38.8 and 17.8% injury and stand reduction, respectively. The common bean variety "Red" showed the highest level of tolerance to fluazifop + bentazon with 22.5% injury...
and 5% stand reduction. During the rainy season, no crop injury was recorded.

**TABLE 4:**

<table>
<thead>
<tr>
<th>Crop</th>
<th>Fluazifop + bentazon</th>
<th>Fluazifop</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>common beans</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>776.0*</td>
<td>225.0</td>
<td>359.8</td>
</tr>
<tr>
<td>Red</td>
<td>192.7</td>
<td>270.0</td>
<td>292.3</td>
</tr>
<tr>
<td>Maringue</td>
<td>373.5</td>
<td>421.5</td>
<td>438.3</td>
</tr>
<tr>
<td>Multi-color</td>
<td>175.5</td>
<td>191.3</td>
<td>210.0</td>
</tr>
<tr>
<td>Earth-color</td>
<td>497.0</td>
<td>546.5</td>
<td>713.2</td>
</tr>
<tr>
<td>cowpea</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>soybean</td>
<td>-α</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>peanut</td>
<td>-β</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

*No significant difference was observed for different herbicide treatments.*

α No growth. β Not determined

Fluazifop applications resulted in 91.3% and 98.8% control of *S. barbata* and *C. dactylon*, respectively (Table 1). However, when tank-mixed with bentazon, its activity dropped to 38% for *S. barbata* and 88.8% for *C. dactylon*. This result suggests that bentazon is an antagonist of fluazifop for control of these weed species. Similar results have been reported by Ross and Lemb (7) for control of johnsongrass (*Sorgum halepense*). The negative interference of these two chemicals may be avoided by applying individual herbicide separately, and at different times. Control of *M. pudica* with fluazifop + bentazon was only fair with 66.4% at 6 weeks after treatment (Table 1).

However, *A. conyzoides* was very well controlled with this combination, and 98% control ratings were observed.

During the rainy season, the growing period of the different crops was reduced (Table 2). The difference ranged from 32 days for the common bean variety ‘Maringue’ to 2 days for peanut. In general, all crops produced high yield in the rainy season compared to the dry season (Table 3 and 4).
**Samenvatting:** Veldproeven werden uitgevoerd in Oschang, Kameroen, gedurende het droog seizoen (1991) en het nat seizoen (1992) om het effect na te gaan van de behandeling met fluazifop-P (250 g a.s./ha) en het mengsel fluazifop-P (250 g a.s./ha) en bentazon (750 g a.s./ha) op de onkruiden en op de voedingsgewassen: aardnoot, soja, Vigna unguiculata en verschillende locale bonenvarieties. *Setaria barbata* en *Cynodon dactylon* werden voor respectievelijk 91 en 98% gekontroleerd op proefveldjes behandeld met fluazifop. Bijmenging met bentazon deed de activiteit van fluazifop dalen tot 38% op *Setaria barbata* en tot 88% op *Cynodon dactylon*. Breedbladige onkruiden daarentegen (*Mimosa pudica* en *Ageratum conyzoides*) werden beter gekontroleerd met het mengsel. Significante gewasbeschadiging (22-67%) werd gekonstateerd op alle varietes gedurende het droog seizoen na behandeling met het herbicidenmengsel. Vigna was het meest gevoelig. In tegenstelling met de opbrengst van 138,5 kg/ha op het onbehandelde vignadie daalde deze tot 47 kg/ha na behandeling met het herbicidenmengsel.

**Literature**


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