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

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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 ai/ha) and fluazifop-P (250 g ai/ha) plus bentazon (750 g ai/ha). Different legume crops included: peanuts, soybeans, cowpea, and common beans varieties white, red, maringue, multi-color and earth-color.

Plots treated with fluazifop resulted in 91 and 98% control of Setaria barbata *and* Cynodon 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 (47 kg/ha compared to 145 kg/ha for fluazifop used alone or 138.5 kg/ha for the control).

Résumé

Des essais en champ étaient conduits à Dschang, Cameroun en saison sèche (1991) et en saison des pluies (1992), en vue d'évaluer l'effet du fluazifop-P et du mélange fluazifop/bentazon sur les adventices et quelques cultures légumineuses (arachide, soja, niébé et les variétés de haricot comun: blanc, rouge, maringue, tout-couleur et couleur-terre).

Les parcelles traitées avec le fluazifop ont permis de controller le Setaria barbata, *et le* Cynodon dactylon *à 91 et 98% respectivement. Cependant, mélangé an 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 controllées 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. Traité 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 hypogea*) 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 technics are very time consuming and can cause serious losses to crops such as peanut especially when gynophores 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 *Cynodon 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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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/m ^{2}), while *C. dactylon* and *M. pudica* infestations were moderate (about 50 plants/m ^{2}) 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 whith four replications. The first factor included soybean; peanut; cowpea; and five local and stable varieties of common bean (White, Red, Maringue, Earth-color and Multi-color), identified according to the seed testa color. The second factor included the untreated control, fluazifop (250 g ai/ha) and fluazifop (250 g ai/ha) plus bentazon (750 g ai/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 Galinsoga* 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 1 :

Percent weed control assessed 6 weeks after post-emergence application of fluazifop and fluazifop + bentazon in 1991 and 1992.

Weed species	Fluazifop + bentazon	Fluazifop	Control
Setaria barbata	38.0 b*	91.3 a	0 b
Cynodon dactylon	88.8 b	98.8 a	0 c
Mimosa pudica	66.4 a	0.0 b	0 b
Ageratum conyzoides	98.0 a	18.8 b	0 c

* 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 :

Number of days before harvest of different legume crops grown in Dschang-Cameroon.

Crops	Number of days before harvesting		Difference
	dry season (D)	*rainy season (R)*	*D–R*
common beans			
White	123	92	31
Red	96	89	7
Maringue	118	86	32
Multi-color	107	98	9
Earth-color	103	86	17
cowpea	126	– α	–
soybean	123	– β	–
peanut	151	149	2

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

TABLE 3 :

Legume crops yield (kg/ha) as affected by post-emergence application of fluazifop and fluazifop plus bentazon in 1991.

Crop	Fluazifop + bentazon	Fluazifop	Control
common beans			
White	184.5 a*	209.5 a	181.8 a
Red	183.3 a	210.0 a	275.0 a
Maringue	176.5 a	245.9 a	247.5 a
Multi-color	124.5 b	162.4 ab	191.2 a
Earth-color	163.5 a	163.6 a	208.0 a
cowpea	47.0 b	145.8 a	138.5 a
soybean	129.5 a	146.5 a	129.2 a
peanut	ND	ND	ND

*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 :

Legume crops yield (kg/ha) as affected by post-emergence application of fluazifop and fluazifop plus bentazon in 1992.

Crop	Fluazifop + bentazon	Fluazifop	Control
common beans			
White	776.0*	225.0	359.8
Red	192.7	270.0	292.3
Maringue	373.5	421.5	438.3
Multi-color	175.5	191.3	210.0
Earth-color	497.0	546.5	713.2
cowpea	0	0	0
soybean	– α	–	–
peanut	– β	–	–

*No significant difference was observed for different herbicide treatments.
α No growth. β Not determine

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 Lembi (7) for control of johnsongrass (*Sorghum halepense)*. The negative interaction 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 treatement (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).

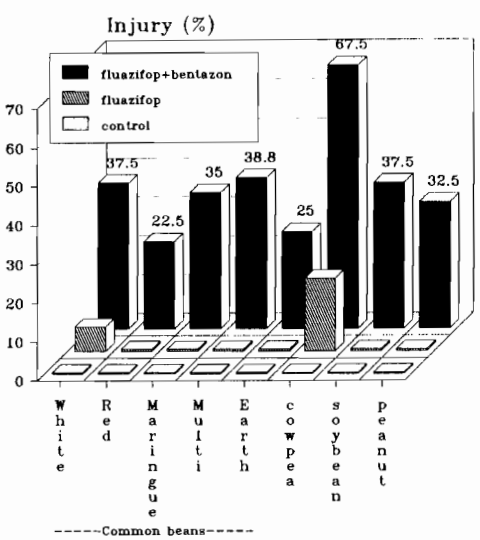

Figure 1: Crop injury 2 weeks after post-emergence application of fluazifop and fluazifop plus bentazon in 1991. No crop injury was observed in 1992 (rainy season).

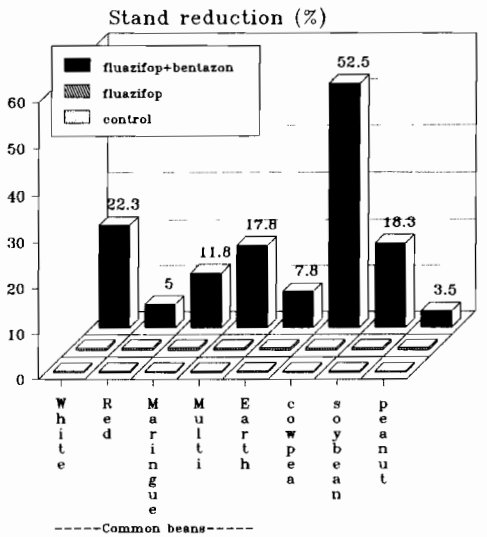

Figure 2: Stand reduction by post-emergence application of fluazifop and fluazifop plus bentazon in 1991 (4 weeks after application). No stand reduction was observed in 1992 (rainy season).

However, during the same growing season, cowpea yield was completely eliminated due to Ascochyta blight infection attacks (Table 4).

In 1991 (dry season), significant yield reduction of cowpea and common bean "Multi-color" was observed in plots treated with fluazifop + bentazon (Table 3). In cowpea, grain yield of 47 kg /ha was obtained in plots treated with these herbicides, compared to 138.5 kg/ha in the control plots, and 145,8 kg/ha in plots treated with fluazifop alone. Herbicide combinations reduced the common bean "Multi-color" yield from 191.2 to 124.5 kg/ha. These results reflect the high level of injury (Figure 1) and stand reduction (Figure 2) observed on these crops.

In 1992 (rainy season), no significant effect of treatments on yield was recorded (Table 4). This was certainly due to the high level of tolerance of different crops to herbicide treatements (Figure 1 and 2). In the same season, disease attack eliminated yields in cowpea while soybean did not grow at all.

Conclusions

Tank-mixture of fluazifop and bentazon caused serious injury to the crops with the most susceptible species being cowpea. This herbicide combination should then be avoided on the varieties tested, especially in the dry season.

The combination of fluazifop and bentazon provided a broadspectrum activity for control of both grasses and broadleaf weeds. However, herbicide combination resulted in reduced control of *S.barbata* and *C. dactylon*, compared to fluazifop applied alone.

Samenvatting: Veldproeven werden uitgevoerd in Dschang, Kameroen, gedurende het droog seizoen (1991) en het nat seizoen (1992) om het effekt 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 bonenvarieteiten.
Setaria barbata en *Cynodon dactylon* werden voor respektievelijk 91 en 98% gekontroleerd op proefveldjes behandeld met fluazifop.
Bijmenging met bentazon deed de aktiviteit 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.
Signifikante gewasbeschadiging (22-67%) werd gekonstateerd op alle varieteiten 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 vignaveld daalde deze tot 47 kg/ha na behandeling met het herbicidenmengsel.

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