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YIELD REDUCTIONS CAUSED BY SELECTED WEEDS IN LOWLAND POTATO IN THE DOMINICAN REPUBLIC

Jose P. Morales-Payan, Bielinski M. Santos and William M. Stall. Horticultural Sciences Department, University of Florida, PO Box 110690. Gainesville, Florida USA 32611.

ABSTRACT. Field experiments were conducted to assess the yield loss caused by season-long interference of selected weeds in lowland potato. Naturally occurring weed mixtures and densities were used. Potato yield loss due to the interference of *Euphorbia heterophylla* (1 plant/m^2), *Phyllanthus* spp., *Boerhavia* spp. (0.5 plant/m^2 each), *Portulaca oleracea* (7 plants/m2) or *Eleusine indica* (2 plants/m2) was not significant. *Parthenium* spp., *Amaranthus* spp. and *Rottboellia exaltata* (5 plants/m^2 each) caused 55, 50 and 28% yield reduction, respectively. Mixtures of *Parthenium*, *Amaranthus* and *Euphorbia* (mixture 1) reduced potato yield by 70%, *Rottboellia*, *Eleusine* and *Euphorbia* combined (mixture 2) caused a 34% yield decrease, and mixed stands of *Phyllanthus*, *Eleusine*, *Boerhavia* (mixture 3) and *Portulaca* reduced potato yield by 14%. Results indicate that interactions among the weed species in mixtures 1 and 2 occurred, since yield losses caused by weed mixtures do not follow an non-interactive (neutral or additive) model of yield reductions, whereas mixture 3 did.

INTRODUCTION

Potato (*Solanum tuberosum*) is the most important vegetable-root crop in the world, based on surface area planted and harvested annually. Caribbean countries, such as the Dominican Republic, are not exceptions to this occurrence. Because of potato's short aerial shoots and slow initial growth, weeds can establish rapidly in potato row-middles before canopy closure. Thus, fast-growing weedy species have the potential to become serious threats for healthy potato stands.

Weeds are recognized to cause yield reductions in crops due to interference, which can be separated in two main components: competition and allelopathy. Under allelopathy, weeds release organic compounds into the soil hindering crop growth. Competition is related to the ability of weeds to take advantage of limiting resources, such as water, space, light and nutrients, at the expense of crops. The nature and extent of these two interference components by a given weed determines its aggressivity respecting to the crop.

In agricultural situations, weeds occur in mixed stands, where each mixture represents an unique situation respecting to the amount of interference received by the crop. Therefore, different weed mixtures would yield different damages. The balance of each weed mixture is related to the density of each species involved. The type of response expected can be described in two ways: a) non-interactive (neutral or additive) and b) interactive (Fisher and MacKenzie 1923; Gilbert 1963). In the former model, the individual response of single species is equal to the response of all species involved together, whereas in the latter model individual effects differ from joint response. The scope of this research was to determine the effects of mixed populations of selected weeds on lowland potato yields.

MATERIALS AND METHODS

Field trials were conducted in San Cristobal, Dominican Republic during the winter-spring producing season in lowland conditions, with annual mean temperature of 29.7 C (approximately 25 C in winter), average annual rainfall of 1800 mm and at 43 m above sea level. The soil was classified as an typic quartzipsamment, with pH of 6.9 and organic matter content of 1.0 to 1.2%.

'Kennebec' white potato was planted in single rows on top of 65 cm-wide raised beds with 40 cm separating plants. Weed monocultures and mixtures were based on naturally occurring weeds, densities and mixtures as observed in another weed management study in potato conducted in the same location (Monegro et al. 1990). Weeds evaluated were *Parthenium* spp., *Amaranthus* spp., *Euphorbia heterophylla, Rottboellia exaltata, Eleusine indica, Phyllanthus* spp., *Boheravia* spp. *and Portulaca oleracea.* Season-long interference by the selected weeds was allowed and commercial potato yield was measured 95 days after planting. A treatment description is shown below:

Treatment	Density (plants/m^2)		Density (plants/m^2)
Weed-free control	0	Mixture 1	
		(*Parthenium, Amaranthus, Euphorbia*)	5, 5, 1
Parthenium	5		
Amaranthus	5		
Euphorbia	1	Mixture 2	
		(*Rottboellia, Eleusine, Euphorbia*)	5, 2, 1
Rottboellia	5		
Eleusine	2		
Phyllanthus	0.5	Mixture 3	
		(*Phyllanthus, Boerhavia, Portulaca, Eleusine*)	0.5, 0.5, 7, 2
Boerhavia	0.5		
Portulaca	7		

Treatments were organized in randomized complete block design with 4 replications. Data collected was submitted to analysis of variance (ANOVA) at the 5% significance level to test for treatment effects. If significant differences were found, treatment means were separated by performing a Tukey's HSD test at the 5% level.

RESULTS AND DISCUSSION

Significant treatment effects were observed on commercial potato yield. No significant yield reductions were observed for *Euphorbia, Phyllanthus, Boerhavia, Portulaca* or *Eleusine*. However, *Rottboellia, Amaranthus* and *Parthenium* as well as all 3 mixtures caused significant yield reductions (Figure 1). Maximum commercial potato yield losses were accounted in the mixture 1, representing about 70% of the weed-free control, followed by *Amaranthus* and *Parthenium* monocultures (-50 and -55%, respectively), *Rottboellia* and mixture 2 (-28 and 34%, respectively), and mixture 3 (-14%).

It is apparent that weeds that grow taller and faster than potato, such as *Amaranthus, Rottboellia* and *Parthenium*, take advantage of the initial slow growth rate of the crop to establish their area of influence early in the season, subsequently causing the highest yield reductions as individual species in contrast with short and/or slow growing weeds such as *Euphorbia, Phyllanthus, Boerhavia, Portulaca* and *Eleusine*, which are suppressed under the potato canopy once the crop has the ability to close row-middles. Light may play an important role in the interference relationships of these weed species and potato.

With respect to the weed combinations, mixtures 1 and 2 caused the largest extent of yield reductions and did not follow and non-interactive (neutral or additive) model, whereas mixture 3 did. These findings indicate that interactions among the weeds in mixtures 1 and 2 took place, probably due to competition among species for essential factors.

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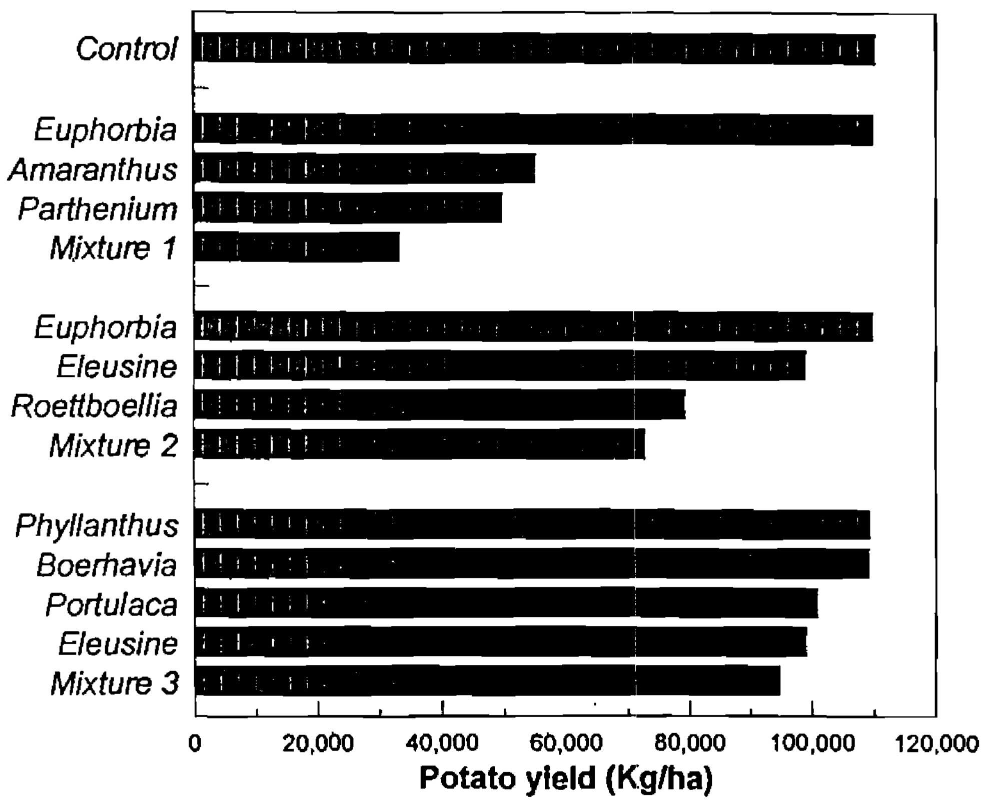

Figure 1. Treatment effects observed on commercial potato yield.