Resumen

El propósito del estudio fue determinar las respuestas de la producción de quinua *(Chenopodium quinoa)* a las aplicaciones de N, P, K en condiciones del Altiplano, Perú. La producción de quinua aumentó significativamente con las aplicaciones de N, mientras que no se encontró significancia para la fertilización con P y K. Los datos confirman la deficiencia de N en los suelos del Altiplano como una fuerte limitación para el logro de buenas cosechas de quinua.

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Fewer beetle pests on beans and cowpeas interplanted with banana in Costa Rica

Sumario. Se muestrearon especies de escarabajos con una red, en parcelas de frijol y caupí sembrados en monocultivo y en policultivo con banano, en Costa Rica. Las densidades de **Diabrotica balteata y Cerotoma ruficornis Rogersi** en monocultivos fueron aproximadamente tres veces sus densidades en policultivos. Tales diferencias grandes podrían explicar en parte las ventajas de policultivos de leguminosas.

Introduction

Beans and cowpeas are frequently interplanted with other crops throughout the subtropics and tropics. What are the advantages of growing the crops in polycultures? Alth much speculation has focused on the possibility that there are fewer insects pests on these crops when interplanted, there has been little empirical work. Studies in annual cropping systems in the neotropics have shown that there are fewer beetle pests on bean when interplanted with corn (1) or with corn and squash (2). This communication demonstrates that there are significantly fewer beetles *(Diabrotica balteata and Cerotoma ruficornis* Rogersi) on beans and cowpeas when interplanted with banana. Both *D. balteata* and *C. ruficornis* are important pests throughout Central America. The adults eat the leaves and flowers of the plants and transmit viral diseases. The larvae eat the roots.

Materials and methods

The beetles were sampled from bean and cowpea plants in three monocultures of bean *(Phaseolus vulgaris,* 'CATIE-1'), three monocultures of cowpea *(Vigna unguiculata,* 'V-44'), three polycultures of bean-banana, and three polycultures of cowpea-banana. In each case, one monoculture was planted immediately adjacent to a comparable polyculture so thtat there were three pairs of bean monoculture/bean-banana polyculture, and three pairs of cowpea monoculture/cowpea-banana polyculture. Each plot was 10 m x 10 m. Beans and cowpeas were planted at the same density in all plots. The work was conducted in July, 1976, at the Tropical Research and Training Center at Turrialba, Costa Rica.

The beetles were sampled with a standard sweep net 38 cm in diameter when the beans and cowpeas were approximately six weeks old and about 35 cm in height. It is at this stage of plant growth that there is the highest number of beetles per plant. The banana was approximately 3 m in height and provided considerable shade, yet the bean and cowpea plants appeared to be, if anything, larger and more luxuriant in the polycultures than the monocultures.

Sweeping was done in roughly straight lines and the same vegetation was never swept twice. The sweep net was swung in an arc covering approximately 1.5 m, with the net coming into contact with vegetation for a distance of 0.75 to 1 m and to a depth of about 15 cm. During the daylight hours, at which time the sweep sampling was done, nearly all the beetles are in the top 15 cm of the plants. One hundred forty sweeps were taken in each plot.

Results and discussion

Table 1 shows the number of *D. balteata* and *C. ruficornis* sampled from bean and cowpea plants in monocultures and polycultures. There were significantly more beetles of each species in monocultures than polycultures ($P < 0.05$, paired t test).

While there was considerable variability in the monoculture-polyculture difference from one pair of plots to another, there were usually at least three times as many beetles in the monocultures than the interplanted treatments.

Whether or not such large differences in beetle population translate into yield differences will depend to some extent on when the differences first appear. The beetles do most of their damage when the plants are quite young (probably during the first four weeks) by directly reducing photosynthetic surface area and by infecting the plant with viral disease. Previous work has shown that one of the reasons that there are fewer beetles in polycultures is due to shade created by overstory crops; beetles prefer to feed in unshaded areas

Table 1.—Numbers of beetles obtained in sweep samples of beans and cowpeas in monoculture and in dicultures with bananas. ( ) = numbers in diculture 140 sweeps per sample.

	Plot Nº	D. balteata	C. ruficornis rogersi
Bean	1	319 (76)	29 (18)
	2	212 (79)	19 (8)
	3	123 (16)	24 (3)
Cowpea	1	92 (1)	61 (24)
	2	57 (23)	37 (27)
	3	22 (1)	39 (0)

(3). In annual cropping systems in which corn provides the shade, the understory beans don't benefit from the shade until approximately 45 days after planting after most of the damage to beans has been done. However, in an intercropped system with a perennial such as banana, sufficient shade can be provided at the start of the season to deter beetle colonization of beans and cowpeas. Yet this will obviously require the use of legume varieties that are somewhat shade tolerant.

Beans and cowpeas can also benefit from being intercropped with shade-producing annuals such as corn, despite the fact that the corn does not produce enough shade to deter beetles until fairly late in the season. If very large areas are planted to these polycultures over a number of seasons, there will be a gradual decline in bettle numbers over time. This will occur because the effect of decreased beetle abundance on the legumes towards the end of one season will be felt by the new legume seedlings in the next season. As long as the area planted to polyculture is large enough, high numbers of beetles would not be likely to immigrate into the area during the first few weeks of the season. Using annuals such as corn as opposed to perennials to provide the beetle-deterring shade would eliminate the need for careful selection of shade-tolerant legume varieties. It would, however, require agricultural planning (i.e., planting of only polycultures) on a scale larger than is tyipical in the tropics.

Summary

Pest beetles were sampled with a sweep net from beans and cowpeas growing in monoculture plots and in polyculture plots with banana in Costa Rica. There were approximately three times as many *Diabrotica balteada* and *Cerotoma ruficornis* Rogersi on beans and cowpeas in monocultures than polycultures. Such large differences might account for some of the benefits of legume interplanting.

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Observaciones sobre la presencia de Exomalopsis pulchella Cresson, polinizador del tomate en Cuba; consecuencias para la producción de semillas

Abstract. During several trips in Cuba, we observed pollinating activity of **Exomalopsis pulchella** on tomato. High levels of natural cross pollination (NCP) observed in similar conditions with this insect, lead us to recommend precautionary measures to maintain varietal pureness in tomato collections and seed production.

Introducción

Durante varias estancias en Cuba, pudimos observar la presencia de una pequeña abeja que polinizaba muy activamente el tomate.

En todos los campos visitados, este polinizador estaba presente. En 1975, Kaan lo señaló en Santiago de Las Vegas (INIFAT). En 1976, Anais y Laterrot (1) pudieron observarlo en la estanción experimental Liliana Dimitrova en Guira de Melena (provincia de La Habana) así como en el C.E.S.T. El Tomeguin, igualmente en la provincia de Las Villas en el CEMSA, en el plan Yabu, en Charco Azul, y en la provincia de Pinar del Río en la Finca Candelaria. En 1979, volvimos a ver este polinizador en varias regiones, particularmente en la provincia de Matanzas en plantaciones de tomate y en el Centro Experimental de Vegetales "Liliana Dimitrova" donde hemos capturado algunos especímenes. Fueron determinados por Torregrossa* como *Exomolopsis pulchella*. Esta pequeña abeja salvaje fue descrita por Pastor Alayo (5) en Cuba en 1976 y es probable que exista en toda la isla.

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