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# EFFECTS OF PHOSPHORUS FERTILITY REGIMENS AND COMMON LAMBSQUARTERS (*Chenopodium album*) INITIAL REMOVAL TIMES ON LETTUCE (*Lactuca sativa*)

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**ABSTRACT.** Field trials were carried out in organic soils naturally deficient in phosphorus (P) fertility to determine the effects of different fertility regimens of this nutrient and common lambsquarters initial removal times on lettuce marketable yields. Phosphorus was either banded (125 Kg P/ha) or broadcast (250 Kg P/ha) prior to lettuce planting. A single lambsquarters population density of 4 plants per 5.4 $m^2$ was allowed to interfere with "South Bay" lettuce within each P regime. Lambsquarters were removed at 2, 4, 6 or 8 weeks after lettuce emergence, along with the weed-free control. When lettuce was grown under weed-free conditions, banded P increased lettuce marketable yields by 27% compared to P broadcast. With banded P, no significant differences were observed between the 2 week removal and the weed-free control. On the other hand, differences were accounted between the weed-free control and the 2 week removal (aproximately 24% reduction). No differences on lettuce marketable yields occurred after 4 and 6 weeks for broadcast and banded P, respectively. Maximum yield reductions of about 47 and 51 % for banded and broadcast P were measured. These findings suggest that banding P in lettuce stands increase the time of lambsquarters interference necessary to reduce lettuce yields.

## INTRODUCCION

Weed interference against vegetable crops is one of the main components of yield reductions in agricultural settings, in most cases needing high economic imputs for management. Weed competition occurs mainly for nutrients, water, light and space. These factors, when provided to crops in necessary amounts, cause maximum stimulus of the crop genetic potential. Competition is related to the ability of individual species to exploit essential factors efficiently. Among these essential factors, nutrients have been recognized as an important source for crop/weed interactions (DiTomaso 1995). Although, nutrients are known to influence competitive interactions (Alkamper 1976; Liebman 19899; Moody 1981), little attention has been offered in the past to this type of studies.

Phosphorus, one of the most important macroelements for plants, is a relatively immobile nutrient in the soil profile (Sample et al. 1980). Histosols are not an exception to this case, requiring P fertility because soil levels are relatively unavailable to crops (Hochmuth et al. 1994). Lettuce (*Lactuca sativa L.)* production in Florida is mostly concentrated in the Everglades Agricultural Area (EAA), accounting for more than 80% of the total state production (Dusky et al. 1988). Since, most lettuce is grown in muck soils, high P levels should be provided to the soil to satisfy its requirements. However, weeds are often more aggresive than crops absorbing nutrients, particularly P, which requires a profuse root system to enhance uptake. Therefore, P placement into the soil plays a significant role in the extent and nature of competitive interactions between weeds and crops.

Common lambsquarters *(Chenopodium album)* is an important weed in the EAA. When grown unchecked, this species could cause significant lettuce yield reductions. However, reports about the extent of interference of this weed with lettuce under different P regimes and rates have not been offered. At the same time, public pressure to reduce P utilization in agricultural fields where potential water table pollution may occur have prompted the researchers about the necessity of seeking new weed control strategies within an overall integrated weed management program. This is particularly true for lettuce fields, where weed control methods used are hoeing and cultivation, which can be expensive and cause damage to roots.

Previous studies have suggested that lettuce yield reductions due to weed competition occur during the first five weeks (Dusky et al. 1988). A detail explanation about the duration of common lambsquarters interference necessary to reduce lettuce yields is needed by farmers who could play with new alternatives managing this weed and probably reduce the economic imputs necessary to obtain healthy lettuce stands. The objective of this research was to determine the influence of common lambsquarters duration of interference on lettuce marketable yields as affected by P application method.

## MATERIALS AND METHODS

The influence of initial removal times of common lambsquarters on lettuce marketable fresh weight was assessed under field conditions at the Everglades Research and Education Center of the University of Florida in Belle Glade during fall 1996 and spring 1997. Soil was classified as a Pahokee muck (Euic hyperthermic Lithic Medisaprist), low in P content as revealed by soil tests (3.0 mg/l), which is unsatisfactory for healthy lettuce growth (Hochmuth et al. 1994; Sanchez et al. 1990). Average day/night temperature were 28/17° C, percentage of organic matter was about 75% and soil pH of 6.3.

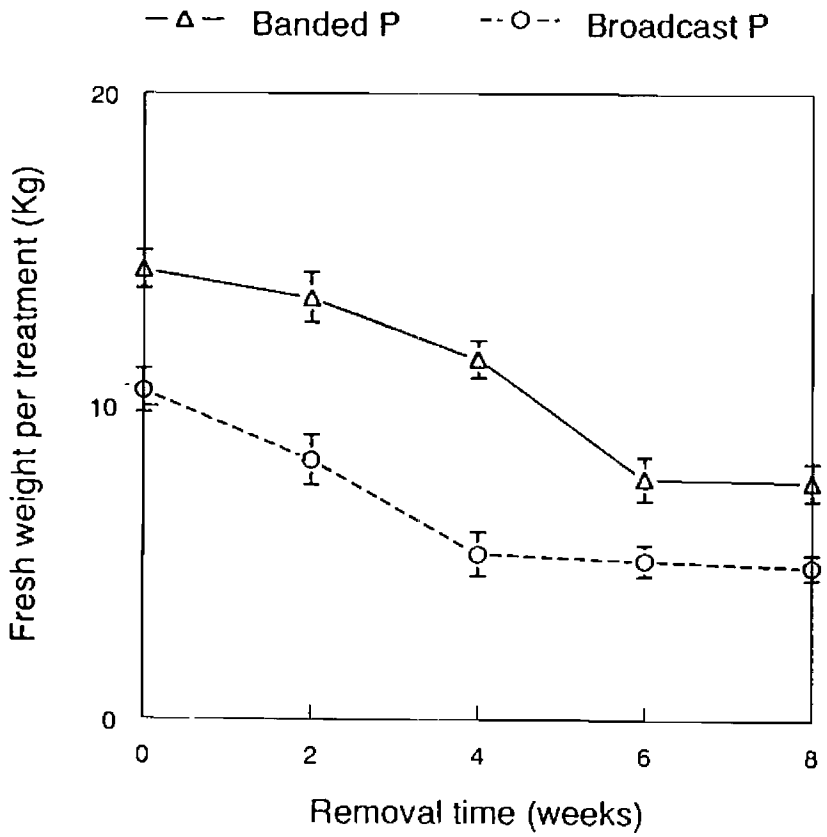
Following soil test recommendations, 250 or 125 kg P/ha were either broadcast or banded 5 cm beneath each lettuce row, depending on the treatments to be established. Twin rows of "South Bay" lettuce were directly seeded on 0.90 m-wide planting beds. Fifteen days before lettuce planting, common lambsquarter seeds were sown in styrofoam multi-cell trays (24 $cm^3$/cell) and grown until they reach the two-true leaf stage. Seedings (approximately 5 cm in height were transplanted in the middle of twin lettuce rows at a density of 4 plants/6 m row. Duration of interference was achieved by removing a given weed after 2, 4, 6 or 8 weeks after lettuce emergence. A weed-free control was established. Other weeds were removed by hand and/or hoeing.

When appropriate head firmness was reached, lettuce fresh weight and head number were measured from the central 50% surface area of each treatment. Outermost wrapping leaves were removed and discarded before weighting heads. A split-plot design was utilized, with P regimes being the main plots and weed removal time as subplots. A factorial arrangement was established with two P fertility regimes, five weed removal times and four replications. Data was subjected to analysis of variance (ANOVA) to test for single factor effects and interactions. Treatment means were separated and compared by standard errors calculated from the resulting data for each measured variable.

## RESULTS AND DISCUSSION

A significant P fertility regime by common lambsquarters removal time interaction was observed for lettuce marketable fresh weight, but not for head number (data not shown). In weed-free situations, lettuce head fresh weight was enhanced adding P in bands compared to broadcast applications, representing a net increase of about 27% in gained yields (Figure 1). Lambsquarters interference caused significant lettuce yield reductions (-20%) after 4 weeks of interference compared to the weed-free control when P was banded, whereas this period of time was reduced to 2 weeks when P was broadcast (-21%). No differences on lettuce marketable yields ocurred after 4 and 6 weeks for broadcast and banded P, respectively. Maximum yield reductions of about 47 and 51% for banded and broadcast P were measured. Knowing that the number of lettuce heads remained the same in all treatments, it is obvious that the effect of this weed on lettuce is measured by diminishing quality and individual head weight.

Figure 1. Effects of different common lambsquarters (*Chenopodium album*) removal times on lettuce head fresh weight with banded and broadcast phosphorus (P) applications.




The data analyzed indicates that the balance of the common lambsquarters-lettuce competitive interactions in terms of duration of interference could be changed by modifying fertilization practices that aim to broadcast P to give an additional advantage in the lettuce root, it causes a similar effect to adding larger broadcast P amounts as it has been suggested in previous studies, where increasing the amount of P available enhanced the competitive

ability of lettuce against smooth pigweed, spiny amaranth and common purslane (Santos et al. 1997; Shrefler et al. 1994). Additional studies have to be conducted to determine the specific mechanisms of interference of common lambsquarters on lettuce.

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