The Search For Improved Lima Bean Yields: A Starting Point

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Introduction

Lack of consistency in yields, an average yield that has remained on a plateau for the last 30 years, and a significant difference in yield for the same variety in two production areas was the reason for the documentation of lima bean development and the comparison of lima bean production in Delaware and in California. Although the lima bean plant produces a tremendous number of reproductive structures during its life cycle, only a small percent of these structures are retained on the plant at harvest. The documentation of the formation and abscission of these structures will help identify problem areas during development and provide insight for plant breeders in the effort to improve lima bean yields. A comparison was made between Delaware and California because California's average yields (3,500 lbs/acre) are consistently higher than Delaware's average yields (1,700 lbs/acre) even though the same variety is used for both states.

Methods And Materials

Plantings were conducted in Delaware and California in 1991 and 1992. The variety Maffei 15 was used. The plants were grown using production practices specific to each area. The experimental design used was a randomized complete block design with five replications. Row spacings were 30 inches with seed at a 1 1/2 inch depth. Fertilization was done according to soil test. Overhead sprinkler irrigation was used in Delaware, while furrow irrigation was used for California. Plant populations used were those common to each area: 4 seeds per foot of row in Delaware and 7 seeds per foot of row in California. 1992 populations were modified after analysis of the 1991 data. Both 4 and 7 seeds per foot of row were used in each state for 1992. Three plantings were compared in 1991 with emphasis on planting date. An early planting on May 16, 1991 in Delaware received very warm growing conditions, while a later planting on July 31 experienced cooler growing conditions. The California planting was planted on June 15, 1991. Emphasis was shifted to plant populations in 1992 with plantings occurring on May 27, 1992 in Delaware and June 12, 1992 in California.

Lima bean developmental data was taken from one plant per replication. Reproductive structures were counted on two racemes from each plant three times per week. Data collection began at flowering and the following structures were counted: swollen buds, flowers, immature pods (pins), and maturing pods.

Weather data was collected for both states in 1991 and 1992. This information will be correlated with count data to see if identification of problem areas during plant development is possible.

Final yield data was taken from a one row, ten foot harvest section. The following information was obtained: number of plants, total plant weight, number of flat, moldy, green harvestable pods, dry harvestable pods, weight of the shelled green beans and the weight of the dry beans.

Results and Discussion

Count data for both 1991 and 1992 revealed that a lima bean inflorescence produces reproductive structures more than one time during the life cycle of the plant. After the original production of structures (buds, flowers, pins and pods) the plant does not remain idle, but will continue to produce more structures or "reflower." A greater number of pods originating from reflowering are retained at harvest in California than in Delaware. Daily pin and pod formation and abscission indicate that the development of these structures in Delaware occurred early in plant development for both planting dates. Pin and pod formation occurred later in plant development in California.

High night temperatures in conjunction with high relative humidity have an adverse affect on lima bean yields according to Fisher and Weaver.[1] Therefore, minimum temperatures were compared for 1991 plantings in the preliminary analysis of weather data. The early planting in Delaware had the highest minimum temperatures followed by California. The lowest minimum temperatures occurred during the late planting in Delaware. Although the late planting in Delaware had the coolest night temperatures, it did not have the highest yield. Further analysis of the weather data will be completed.

Final yields in California in 1991 were higher than both Delaware plantings. There was no significant yield difference between the early and late Delaware plantings. Plant populations differed between the two states, but the number of pods per plant were approximately the same for all three plantings. The number of harvestable green pods/acre was much higher for the California planting, indicating an increase in population should increase yield. The 1992 studies compared 4 and 7 seeds per foot of row in both states. Final yield data reveals no significant difference in total plant weight, number of harvestable green pods, and final yield between treatments within each state, but there was a significant difference between the two states at the 4 seeds per foot spacing. Conclusions for the 7 seeds per foot spacing could not be made due to poor stand in California. California final yields were higher than Delaware final yields. Pods per plant and number of harvestable pods per acre in California were much higher than those in Delaware in 1992.

The continued flowering or reflower mechanism of the lima bean plant is important to California yields. Timing of pin and pod formation and abscission does differ in Delaware and California. A significant difference in final yield data is found at 4 seeds per foot in Delaware and California. Increasing the number of seeds per foot of row from 4 to 7 in Delaware does not increase final yield.

References

1. Fisher, V.J. and Weaver, C.K. 1974. Flowering, Pod Set, and Pod Retention of Lima Bean in Response to Night Temperature, Humidity, and Soil Moisture. J. Amer. Soc. Hort. Sci. 99:48.