SEED YIELD AND BIOMASS WERE ASSOCIATED WITH EVAPOTRANSPIRATION AND GROWTH DEGREE DAYS IN *Phaseolus vulgaris* L.

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Introduction

In Mexico, the common bean (*Phaseolus vulgaris* L.) is a crop of major importance for human consumption. The cultivar Michoacan 12A-3 was collected and cultivated in Central Mexico for several years.

The growth of a crop depends on diverse environmental factors; i.e., solar radiation, rainfall, temperature, and evapotranspiration (Etc) (Dirks and Bolton, 1981). Several studies have found a positive relationship between Etc and yield in some crops such as corn, wheat and bean (Liang *et al.*, 1991; Musik *et al.*, 1994; Escalante *et al.*, 2001). Growth degree days (GDD) calculated from temperature have also been found to correlate positively with the yield (Muchow *et al.*, 1990; Escalante *et al.*, 2001). The objective of the present study was to determine the relationship of Etc, GDD, and rainfall to biomass production and seed yield in a temperate region of Central Mexico, where cv. Michoacan 12A-3 was cultivated for several years.

Materials and Methods

Data was collected on biomass production and seed yield of *P. vulgaris* cv. Michoacan 12A-3 from several sowings carried out in Chapingo, Central Mexico (98°54' N, 19°48' W, 2250 above sea level, with a temperate climate). Ten sowings were carried out in Chapingo from 1973 to 1993 in the spring-summer cycles under rainfed conditions. Meteorological data (temperature, precipitation, and Etc) were collected, corresponding to the sowing date and the physiological maturity of each year.

Results and Discussion

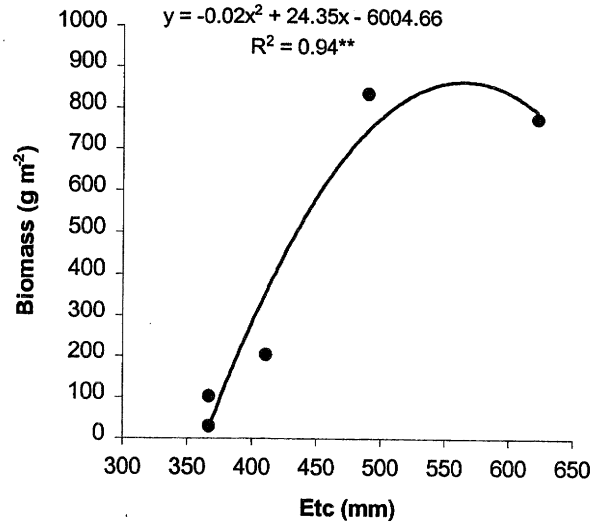
The ten sowings had different plant densities and diverse fertilization levels, and little relationship was found association between biomass production and seed yield and Etc, precipitation and GDD (r ranged from 0.06 to 0.32). However, when only some years were considered, the relationship increased as shown in Figure 1 and Table 1. The association among Etc with biomass production (5 years) and seed yield (7 years) was significant at $p \leq 0.01$ in both cases. Similar results have been found in bean in hot and temperate weather (Escalante *et al.*, 2001).

Table 1. Correlations between meteorological and yield parameters.

Parameter	Biomass	Seed yield
	r[†]	r[‡]
Evapotranspiration	0.87	0.88
Precipitation	0.32	-0.12
GDD	0.75	0.68

[†](1973, 1974, 1977, 1978 and 1980)

[‡](1973, 1974, 1977, 1978, 1980, 1985 and 1986)



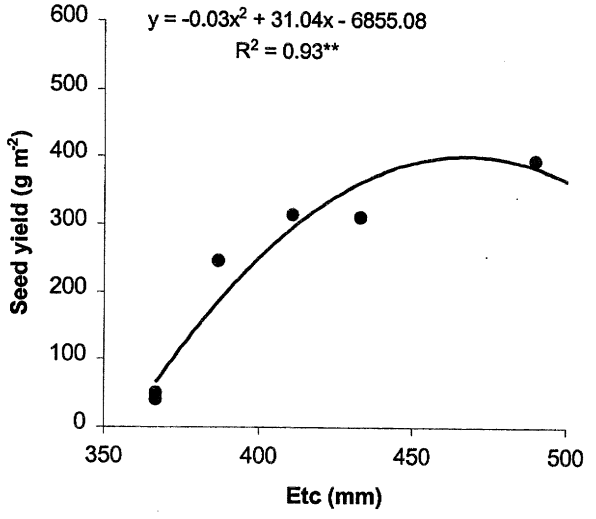


Figure 1. Relationship of biomass and seed yield with evapotranspiration (Etc) (mm).** level of significance $p \leq 0.01$.

There was no association of biomass and seed yield with precipitation; this may be due to auxiliary irrigation applied during the first growth stages. GDD was significant ($p \leq 0.05$) for biomass production ($r^2=0.76$), but not for seed yield ($r^2=0.42$).

The most important parameter associated with yield was Etc for the cv. Michoacan in the different sowings of Chapingo.

Conclusion

There was a high relationship between Etc and biomass (5 years) and agronomic yield (7 years). GDD showed a significant association only for biomass.

References

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