Shade, Irrigation and Fertility Effects on Biomass Production in American skullcap

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Introduction

A growing interest in medicinal herbs has resulted in the need to domesticate medicinal plants traditionally harvested in the wild. American skullcap *(Scutellaria lateriflora)*, native to moist habitats in Eastern North America, is known for its sedative properties associated with the flavonoid, scutellarin, and also contains baicalein and baicalin, which have multiple uses. Information on how growing conditions affect the yield and concentration of flavonoids is lacking.

Light, moisture and nutrients affect growth and chemistry of plants (Warren et al. 2003; Zobayed et al. 2007; Glynn et al. 2003). Knowledge on how these factors affect flavonoid content could be used to improve the medicinal value of skullcap through improved crop management practices.

The objective of this research is to evaluate the effect of light, moisture and nutrients on biomass yield and concentration of flavonoids in the above ground part of American skullcap.

The results presented here focus on biomass yield.

Materials and Methods

- Experimental design: 2x2x3 split plot factorial.
- Treatment factors:
  - Shade (40% shade vs. no shade)
  - Irrigation (applied at 30 kPa vs. no irrigation)
  - Nutrients (no fertilizer vs. fertilizer (100 kg N, 68kg P, 42 kg K ha^{-1}) vs. chicken litter (100 kg N ha^{-1}).
- Shade factor in main plot units. Irrigation and nutrient factors in sub-plot units
- Cold stratified seeds were planted in greenhouse and transplanted to field on April 30 2007, 60 days following germination.
- Plot size : 20 x 4 ft (6 x1.20 m x (7.2 m2)
- Harvested area: 5.96m2
- Plant spacing : 2x1 ft (60x30 cm) on 45 cm wide beds
- Harvesting was done at full bloom (June 29 and September 5, 2007). The whole aboveground part of each plant was cut 3 inches (7.5 cm) from the base.
- Fresh and dry weight were determined
- Drying was done in forced air dryer at 40° C.

Fig1: View of the Experimental Site one week following transplantation

Fig 2: seedlings in greenhouse 30 days after germination

Fig 3: seedlings at transplanting stage

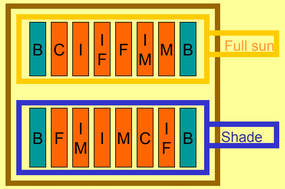

Fig 4: layout of one repetition
(I=irrigation; F=fertilizer; M=manure; C=control; B=border)

Fig 5: Plants under shade and in full sun

Fig.6: Tensiometer

Fig. 7: Harvesting

Fig.8:Plant at harvesting stage

Fig 9: Powdery mildew under shade

Fig. 10: Plants drying under sunlight after harvest

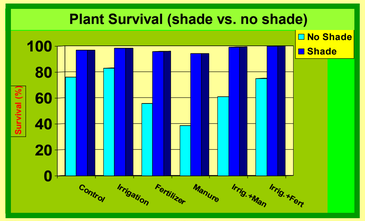

Fig. 11: Percent plant survival

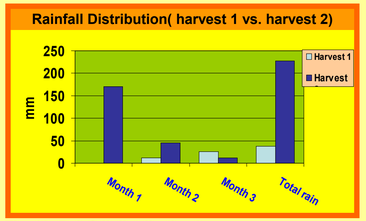

Fig. 12: Rainfall distribution in mm

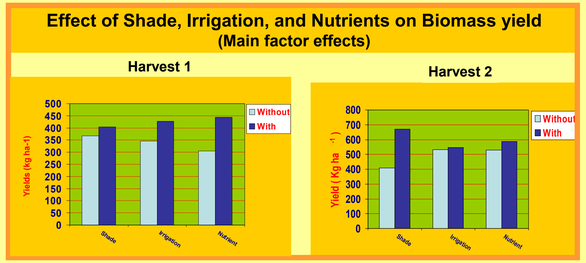

Fig.13: Effect of shade, irrigation and Nutrients on dry matter yield harvest 1 and 2

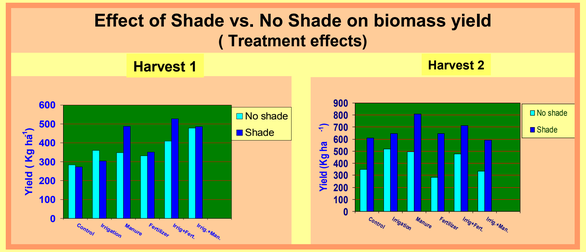

Fig. 14: Treatment effect on biomass yield (harvest 1 and 2)

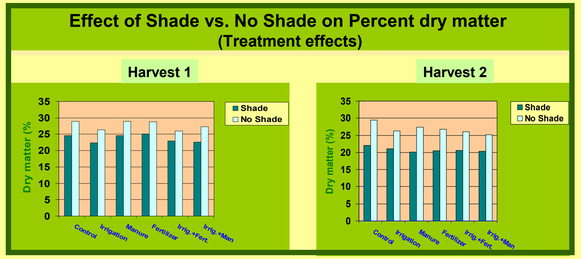

Fig. 15: Treatment effect on percent dry matter(harvest 1and 2)

Results

Effect of Shade

	Harvest 1	Harvest 2
Biomass yield:	No effect	Increased by 63.4%
Height :	Increase by 33%	Increased by 52.3%
% Dry matter :	Decrease by 14.5 %	Decreased by 22.6%
Plant Vigor :	More vigorous under shade than in full sun (both harvests)	
Diseases :	Powdery mildew observed only under shade, not in full sun	
Survival :	Higher under shade than in full sun	

Effect of Irrigation

	Harvest 1	Harvest 2
Biomass yield:	Increased by 23.7%	No effect
Height :	Increased by 12.7%	No effect
% Dry matter :	Decreased by 8.3%	No effect

Effect of Nutrient

	Harvest 1	Harvest 2
Biomass yield:	Increased by 45.7%	Increased by 10.4%
Height :	Increased by 9.9%	No effect
% Dry matter:	No effect	Decreased by 5.5

Discussion

- Higher biomass yield under shade than in full sun at second harvest may be attributed to higher biomass per plant and higher survival rate than in full sun.
- Irrigation had no effect at second harvest due to frequent rainfall during this period.
- The low effect of nutrients on biomass yield at 2nd harvest may be attributed to the fact that no nutrients were added to replace those removed in the 1st harvest or due to leaching.

Conclusion

Preliminary results are encouraging for commercial production of American skullcap in the Southeast. The plant appears to grow better under shade than in full sun, although powdery mildew incidence was greater under shade than in full sun. Addition of water and nutrients also increased biomass yield. Final assessment of the treatments will be based upon analysis of the plants for flavonoid content.

Literature cited

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