

Efficacy of Foliar Fertilization on Cowpea in Northern Tamaulipas

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Additional index words: *Vigna unguiculata*; foliar fertilization.

ABSTRACT

Cowpea (*Vigna unguiculata* L. Walp) is an important exportation legume in northern Tamaulipas. Soil fertilization is not used, but foliar fertilization is common; however, there is no information about the usefulness of this practice. Therefore, a study was conducted to test the efficacy of commercial foliar fertilizers applied in two locations on different soil types. Pinkeye Purple Hull was used, with plantings in August, 1992. The treatments evaluated were Biozyme (0.75 l/ha), Biogen (0.75 l/ha), Cosmofer (4 l/ha), Cosmocel (3 kg/ha), and Iron Sulfate (1%). The number of applications varied according to location. Response was observed only at the location where iron chlorosis was present and iron sulfate (1%) markedly decreased chlorosis and resulted in a significant increase in pod yield and plant height.

RESUMEN

El chícharo de vaca (*Vigna unguiculata* L. Walp.) es una leguminosa importante en la región norte de Tamaulipas y su producción se exporta hacia los Estados Unidos. El productor generalmente no fertiliza el suelo y sólo aplica fertilizantes foliares; no obstante, no existe información sobre la efectividad de estos fertilizantes. Debido a lo anterior, se llevó a cabo un estudio en donde se aplicaron fertilizantes foliares comerciales en dos localidades con diferente tipo de suelo en Río Bravo, Tamaulipas. Las siembras con la variedad Pinkeye Purple Hull se realizaron en Agosto de 1992. Los tratamientos evaluados fueron Biozyme (0.75 l/ha), Biogen (0.75 l/ha), Cosmofer (4 l/ha), Cosmocel (3 kg/ha) y Sulfato Ferroso (1%). El número de aplicaciones varió según la localidad. Sólo se observó respuesta con la aplicación de sulfato ferroso (1%). Soló se observó respuesta con la aplicación de sulfato ferroso (1%) en la localidad que presentó clorosis férrica, en donde se redujo la severidad de ésta y se incrementó significativamente la producción de vaina y la altura de la planta.

Cowpea (*Vigna unguiculata* L. Walp.) is a legume that has been grown for the last 10 years in northern Tamaulipas, where it is exported to the United States. The main producing areas are Río Bravo and Valle Hermoso. In

1990, cowpea were produced on 3,736 ha, which is similar to okra, the principal vegetable crop in this region (Díaz and Leal, 1992). México has virtually no market for cow-

Table 1. Composition (percentage) of foliar fertilizers according to the respective manufacturers.*

Nutrients	Foliar fertilizer			
	Biozyme	Biogen	Cosmofer	Cosmocel
N (Total)	---	2.50	10.00	20.0
P	---	---	5.00	30.0
K	---	---	5.00	10.0
Fe	0.49	0.33	0.06	0.1
Zn	0.37	0.37	0.08	0.13
Mn	0.12	0.44	0.04	0.04
Mg	0.14	0.40	0.025	---
Mo	---	---	0.005	0.003
Ca	---	---	0.025	0.008
Cu	---	---	0.04	0.02
B	0.030	0.06	0.04	0.06
S	0.44	1.00	0.15	1.4
Giberelic acid	0.003	---	0.0006	---
Herb extracts	78.87	23.00	---	---
Indolacetic acid	0.003	---	---	---
Zeatin	0.008	---	---	---
Penetratings	---	1.6	---	---
Solvents	19.26	70.3	79.53	38.22
Vitamin B	---	---	0.0002	---

* Biozyme: Bioenzymas, S.A., Saltillo, Coah.; Biogen: Agroenergía Bioquímica Industrializada, S.A., Reynosa, Tam.; Cosmofer and Cosmocel: Cosmocel, S.A., Monterrey, N.L.

Table 2. Foliar fertilizers application dates at Nuevo Progreso site.

Treatments	Dates		
	8-29	9-4	9-18
Biozyme			X
Biogen			X
Cosmofer	X		X
Cosmocel	X		X
Iron Sulfate	X	X	X
Iron sulfate	X		X
Control			

Table 3. Foliar fertilizers application dates at Río Bravo site.

Treatments	Dates			
	9-9	9-8	9-28	10-9
Biozyme				X
Biogen				X
Cosmofer	X	X	X	X
Cosmocel	X	X	X	X
Iron sulfate	X	X	X	X
Iron sulfate	X	X	X	
Control				

pea and local consumption is only on the Yucatán Peninsula (Laris, 1991).

Because of the market and cropping systems, i.e., corn, sorghum, wheat, or okra, cowpea is planted in August and even September. Growers usually do not use soil fertilizers; however, foliar fertilization is considered an appropriated method of nutrient application, but there are no studies to confirm the usefulness of this practice. Iron deficiencies are common in many legumes, including cowpea (Galván, 1983; Larrea, 1969). This study was conducted in order to compare the effectiveness of various usual commercial foliar fertilizers on cowpea.

MATERIALS AND METHODS

Two separate trials were conducted in commercial fields: one in the Nuevo Progreso area, in sandy loam silt with no previous iron chlorosis on cowpea, and the other in the Río Bravo area, in a silty clay soil with previously documented iron deficiency on cowpea. Planting dates were August 3 and 20, 1992, respectively. Pinkeye Purple Hull variety was planted at both locations, without soil fertilization. The pre-

vious crop was corn. Foliar fertilizer treatments were applied with motorized hand sprayer, in a randomized complete block design with four replications. Plots consisted of four 0.91 m rows, 5 m in length at both locations. Plant spacing was 6 cm. The commercial foliar fertilizer treatments were (see Table 1 for chemical composition); Biozyme (0.75 l/ha), Biogen (0.75 l/ha), Cosmofer (4 l/ha), Cosmocel (3 kg/ha), Iron Sulfate (1%), and control (no application). Rates and applications were according to manufacturer's recommendations.

Measurements were taken at pod formation stage to determine plant height. Chlorosis severity was evaluated on a visual scale, where 0 = no chlorosis, 1 = very light, 2 = light, 3 = moderate, 4 = strong, and 5 = very strong. Cowpea yield were determined by hand harvesting at the green mature pod stage. Yield data were taken in the two central rows. At Nuevo Progreso site there were three harvests, while at Río Bravo, two.

Separate analysis of variance were conducted for each site. Tukey's test was used for means separation ($p = 0.05$).

Table 4. Effect of foliar fertilizers on cowpea at Río Bravo site.

Foliar fertilizer	Rates (ha)/ Applications	Chlorosis severity (0-5)	Plant ** height (cm)	Pod ** yield (kg/ha)
Iron sulfate (1%)	* /4	1	47.4a	1471a
Iron sulfate (1%)	* /3	1	45.7a	1462a
Cosmocel	3 kg/4	3	42.3 b	547 b
Biogen	0.75 l/1	3	42.0 b	487 b
Biozyme	0.75 l/1	3	41.5 b	468 b
Cosmofer	4 l/4	3	41.5 b	403 b
Control	---	3	41.5 b	440 b

* 1 kg/100 l of water.

** Means followed by the same letter are not significantly different by Tukey's test ($p = 0.05$).

RESULTS AND DISCUSSION

Iron chlorosis was registered only at the Río Bravo site. No visual symptoms of leaf burn caused by foliar applications were observed in this study.

At the Nuevo Progreso site, cowpea pod yields averaged 2,008 kg/ha, and treatments showed no significant differences due to foliar fertilization. Plant height averaged 61.2 cm and was also unaffected by the treatments. In contrast, the Río Bravo site showed homogeneous chlorosis, and iron sulfate (1%) in three and four applications, reduced chlorosis to grade 1 (very light), and significantly increased plant height and pod yields (Table 4). Comparing average plant height and yield between iron sulfate and the other treatments, it was estimated that iron chlorosis decreased plant height by 4.79 cm (10.3%) and yield of cowpea pods by 997 kg/ha (68%). These results confirm preliminary studies in this region (Díaz, 1992) and agree with Menges et al. (1981) who stated that iron chlorosis in cowpea reduced plant growth and yield in Texas. Our results also agree with Pérez et al. (1992 a, b) who suggest that iron chlorosis in bean and soybean can be controlled with iron sulfate (1%).

In this study, applications of commercial foliar fertilizers (Cosmocel, Cosmofer, Biozyme and Biogen) had no impact on plant height and yield of cowpea. Even without soil fertilization, soil nutrient levels during the study appeared to be adequate for good production. Blackhurst and Miller (1980) and Pandey (1990) emphasized that, in general, cowpea does not need fertilization. On the other hand, it was evident that greater yields and taller plants occurred at Nuevo Progreso site, apparently because of the soil type (sandy loam) and the absence of iron chlorosis. Blackhurst and Miller (1980) and Menges et al. (1981) reported that best yield of cowpea can be achieved on sandy loam soils.

The results of this study showed that commercial foliar fertilizers applications had no effect on cowpea yields.

However, applications of iron sulfate (1%) to cowpea exhibiting iron chlorosis, registered higher yields.

ACKNOWLEDGMENT

The authors thank Andres Ruiz-Acosta for his assistance in these experiments.

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