OILSEED PRODUCTIVITY UNDER VARYING WATER AVAILABILITY

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INTRODUCTION

Meeting the growing demands for fuel in the United States will require a variety of alternative energy strategies and technologies. One of the emerging sources of alternative energy is biofuels, and one of those biofuels is biodiesel. Biodiesel can be produced from oil extracted from a number of oilseed crops, including canola (*Brassica napus* L.), mustard (*Brassica juncea* L.), camelina (*Camelina sativa* L.), sunflower (*Helianthus annuus* L.), safflower (*Carthamus tinctorius* L.), and soybean (*Glycine max* L.). This paper discusses basic agronomic differences between these crops, their responses to varying water supply, and expected dryland and irrigated yields for northeastern Colorado.

BASIC CROP DESCRIPTIONS

Canola, mustard, and camelina are Brassica crops, among the oldest cultivated plants known to humans (Raymer, 2002). The term "canola" is a registered trademark of the Canadian Canola Association and refers to cultivars of oilseed rape that produce edible seed oils with less than 2% erucic acid (22:1) and meals with less than 30 mmol of aliphatic glucosinolates per gram (Raymer, 2002). In northeastern Colorado all three are generally planted in the early April and harvested in late July. Seed oil contents for these species generally run between 37 and 45%.

Sunflower and safflower are both deep-rooted species. Sunflower is native to the Americas while safflower is believed to have originated in southern Asia. Oil content generally runs from 40 to 47% for both species. Sunflower is generally planted in late May and matures by the end of September, while safflower is planted at the beginning of May and harvested at the end of August.

Soybean is a legume native to east Asia. It is generally planted in mid-May and harvested at the end of September. Oil content generally runs 18 to 20%.

PRODUCTION FUNCTIONS

The seed yield response of five of the six oilseed crops to water use is shown in the figure to the right and the regression equations for the production functions are given in Table 1. The regression slopes (determined at Akron, CO) range from 110.5 lb/a per inch of water use for camelina to 175.2 lb/a per inch of water use for canola. Soybean shows the highest seed yield for any given amount of water use. The production functions estimate that canola, camelina, safflower, and sunflower will all yield about the same for water use in the 15 to 20 inch range (approximately 1470 to 2170 lb/a).

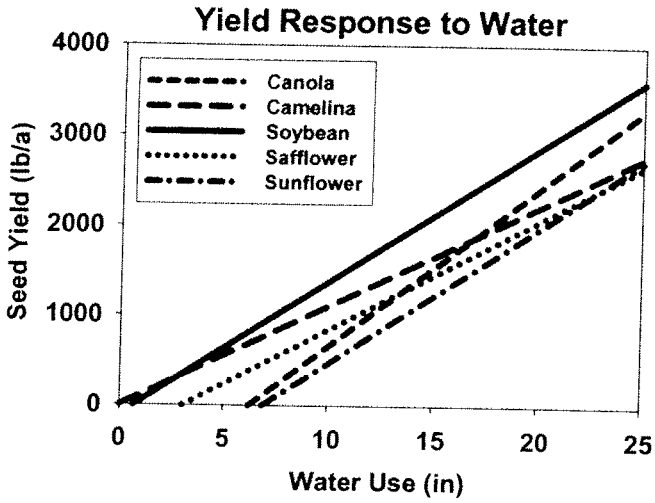

Table 1. Linear regression production functions for five oilseed crops grown at Akron, Colorado.

Crop	Production function (seed yield [lb/a] vs. water use [inches])
Canola	lb/acre = 175.2*(in – 6.2)
Camelina	lb/acre = 110.5*(in – 0.0)
Soybean	lb/acre = 148.1*(in – 0.7)
Safflower	lb/acre = 121.4*(in – 3.0)
Sunflower	lb/acre = 150.6*(in – 6.9)

ESTIMATING YIELDS UNDER A RANGE OF WATER AVAILABILITY

Table 2 shows seed yields predicted using the production functions given in Table 1 (assuming average growing season precipitation and six inches of soil water extraction) at three Great Plains locations. The production functions indicate that soybean would produce the largest yields at all of the locations under all of the water availability conditions. However, soybean yields would likely be lower than shown due to seed loss from not being able to effectively harvest the lowest node of pods (podding to close to soil surface) and seed shatter as pods spontaneously open due to very low afternoon humidity and high winds at harvest time in the Great Plains . Also it should be remembered that the oil content of soybean seed is lower than that of the other oilseed crops. For the