Project Title: Canola and Sweet Lupin -- Potential New Rotation Crops for Central Montana.

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Objectives:

1) Evaluate new regular and specialty canola genotypes from public and private breeders from various regions of U.S. and Canada for adaptation.
2) Evaluate narrow leaf lupine genotypes, from Australia and Poland, for adaptation and yield potential in central Montana.

Results:

1). Canola growth chamber study:
A seeding date study conducted in 2002 and 2003 showed higher seed yield of canola for early planting, but the minimum temperature required for canola to germinate and the heat unit required for canola to emerge are not well known. A growth camber study was conducted to determine the base temperature and heat unit required for germination and emergence of 17 canola cultivars.

Fifty seeds from each variety or breeding line were planted on a germination paper placed inside a Petri dish with three replications. The germination paper was soaked with 15 ml distilled water. The Petri dishes were incubated in a growth chamber under 43, 50, and 59 ^{o}F. Another 50 seeds from each variety or breeding line were planted in a Petri dish filled with sieved Judith clay loam soil with three replications. The seeds were planted at 0.5" depth. Soil moisture was about 20%. The Petri dishes were incubated at 43, 50, and 59 ^{o}F in a growth chamber. The Petri dishes were checked every day and the germination and emergence of the seeds were counted. Germination and emergence rate were calculated by dividing germination and emergence counts to the total seeds planted.

The base temperature (minimum temperature) for germination was found ranging from 33.8 to 38.0 ^{o}F for the canola cultivars in this study, but varied among the cultivars. The heat unit required to reach 50% emergence ranged from 49.9 to 79.9 growing-degree-days, which means that it takes 8 to 13 days for the canola to reach 50% emergence under an average daily

temperature of 6 ^{o}C (43 ^{o}F). There were great variations among the cultivars for the heat units required for emergence (Table 2).

Table 2. Base temperature for germination and growing-degree-day (GDD = average daily Temp x days) required to reach 50% emergence.

Cultivar	Source	Base Temp. (^{o}F)	GDD (^{o}C*day)
UISC00135	U of I	37.0	50.2
96SI510312	U of I	35.5	59.9
Sunrise	U of I	37.2	65.8
95SH2511017	U of I	35.4	56.4
Impact	U of I	36.1	54.1
UISC02314	U of I	36.1	55.9
UISH003197	U of I	35.8	56.5
UISC0038DE	U of I	38.0	53.2
Clearwater	U of I	36.8	54.6
UISC00317	U of I	34.1	79.9
Premier	U of I	36.3	54.4
Garnet	U of I	35.4	79.2
UISH0031923	U of I	36.7	53.3
Sterling	U of I	37.3	49.9
DKL223	Monsanto	33.9	75.2
Hyola357	Interstate	34.7	64.1
DKL3455	Monsanto	37.0	52.3

2). Lupin field study:

Ten narrow-leaf lupin cultivars received from Australia and Poland were planted at the Central Agricultural Research Center, MSU on May 7, 2003. The experiment was a randomized complete block design with four replications. The seeding rate (plant density) was 7 plants/ft^2. No fertilizer was applied, but seeds were inoculated with lupin inoculant prior to seeding. Due to the severe summer drought, lupin suffered severe terminal drought during the flowering and seed filling stages. Therefore, the plants were short and seed yields were very low (Table 3).

Summary:

Due to the severe summer drought in 2003, canola and lupin did not perform well in the field. Yields were extremely low. Although differences were observed among the cultivars, there was not enough evidence to justify the adaptability of the genotypes in this one-year trial under an unusual weather pattern. The growth chamber study shows great variations among canola genotypes in base temperature and heat unit required for emergence. These results will provide a reference for the selection of canola genotypes for early planting. Previous studies have shown yield advantage of early seeding.

Table 3. Narrow-leaf lupin seed source and yield for the field experiment at CARC in 2003.

Cultivar	Source	Species	Yield (lb/a)
Merrit	Australia	*L. angustifolius*	119
Belara	Australia	*L. angustifolius*	46
Kalya	Australia	*L. angustifolius*	111
Tanjil	Australia	*L. angustifolius*	133
Tallerack	Australia	*L. angustifolius*	102
Gungurru	Australia	*L. angustifolius*	141
Taper	Poland	*L. luteus*	135
Polonez	Poland	*L. angustifolius*	13
Atu	Poland	*L. angustifolius*	142
Sonet	Poland	*L. angustifolius*	107

Future Plans:

Specialty crops are needed for crop rotation and diversification of the wheat-based production systems for long-term sustainability and competitiveness. So far, few successful specialty crops have been identified for central Montana. Further studies on variety evaluation and agronomic technology are needed before a suitable crop can be identified. Our research team acknowledges the funding support from the Montana Wheat and Barley Committee for this study.