Fertilizer Facts: December 1999, Number 22

Canola Nutrient Management

Grant Jackson
Western Triangle Ag. Research Center, Conrad

With the development of more reliable pest control methods, canola has become an important oilseed crop that offers small grain producers an excellent rotational crop. Canola is not adapted to the entire small grain growing area of the state, but is adapted to irrigated and higher rainfall areas where daytime high temperatures seldom exceed 90E F. Nutrient management research on canola has been conducted in Montana since 1990 with documented responses to nitrogen (N), phosphorus (P), and sulfur (S).

Initial fertilizer experiments were conducted at Agricultural Research Centers near Conrad, Corvallis, Kalispell, and Moccasin, and results of these studies were published in Montana AgResearch. Since 1993, the research effort has been concentrated in the Western Triangle area of Montana. This Fertilizer Facts summarizes these studies as well as the previous work.

Experiments were located near Bozeman, Conrad, Corvallis, Cut Bank, Fairfield, Moccasin, and Sunburst. All trials were conducted on land previously cropped to small grains. The Bozeman, Conrad, Corvallis, and Fairfield locations were irrigated; all others were dryland (in 1991, Conrad had a dryland location and an irrigated location).

Table 1. Soil analysis summary from 13 locations.

Soil Analysis	Range (mean)
pH[1]	5.9 – 8.2 (7.43)
OM (%)[1]	1.6 – 3.2 (2.28)
NO_3-N (lbs/a)[2]	9 – 145 (46)
P (ppm)[1]	10 – 45 (20)
K (ppm)[1]	179 – 451 (343)
SO_4-S (lbs/a)[3]	23 – 181 (62)

[1] Sample depth of 0-6 in
[2] Sample depth of 0-36 in
[3] Sample depth of 0-12 in

All locations were planted no-till except for the Bozeman, Corvallis, and Fairfield sites which were conventionally tilled by plowing and disking. Planting rates were 5 lbs seed/a for dryland and 7 lbs seed/a for irrigated. Nitrogen rates varied between 0 and 225 lbs N/a. When P was a variable, P rates varied from 0 to 60 lbs P2O5/a, and when S was a variable, S rates ranged between 0 and 40 lbs S/a. When applicable, sufficient levels of N, P, K and S fertilizers were added to ensure optimum nutrient levels other than the one being evaluated. Cultivars or hybrids used were Westar from 1991 to 1996, Hysn 110 in 1997 and 1998, and Hyola 357 RR in 1999. Seed yield and oil content were determined at all locations. In order to estimate the amount of nutrients cycled, N, P, K, and S content of the seed and the above ground portion of canola at maturity were determined in 1995 and 1996 from plots with varying N, and constant P, K, and S. Each site was characterized by soil tests (Table 1) for pH, organic matter (OM), P, K, nitrate-N, and sulfate-S.

Regression analysis was utilized to relate available N (fertilizer N plus soil nitrate-N, 0-36 in. soil depth) and canola yield (Figure 1). As indicated, canola is very responsive to N, and with adequate water and fertility, seed yields of 30 cwt/a are obtainable. The upper curve in Figure 1 was calculated from seven locations where maximum yields ranged between 2400 and 3000 lbs/a (48 to 60 bu/a). Six locations were used in determining the lower curve where maximum yields varied between 1800 and 2200 lbs/a (36 to 44 bu/a). Canola has a test weight of 50 lbs/bu. Producers from irrigated and high yielding dryland locations should use the top curve to estimate N fertilizer needs. In this case, optimum yields require about 200 lbs of available N. Most dryland growers should use the lower curve to estimate N fertilizer needs where optimal yields are obtained with about 150 lbs N/a. Regardless of the N response curve used, canola requires about 3.5 to 4.0 lbs of N/bu for optimum yields. This is due to canola's high harvest index or "straw to grain" ratio. Typically canola produces about four times its grain weight in foliage or residue (stems, leaves, pods, etc.), whereas spring wheat's harvest index is about 1.4. As expected, canola residue is "loaded" with nutrients. Nutrient uptake data indicates that at optimum yield (about 27.5 cwt/a) and available N level (200 lbs N/a), canola residue will contain about 60 lbs N/a, 15 lbs P_2O_5/a, 175 lbs K_2O/a, and 50 lbs S/a.

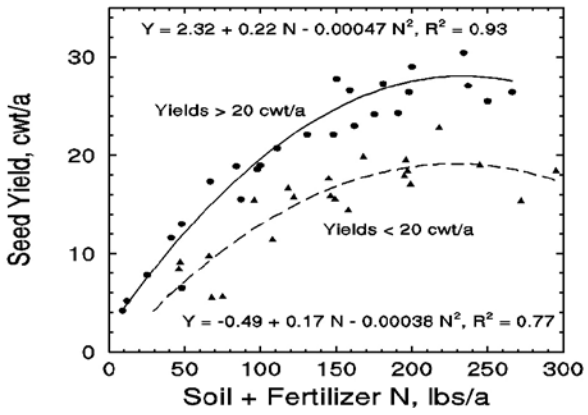

Figure 1. Effect of available N on spring canola yield.

Seed oil content varied from about 39% to over 50%, and as shown in Figure 2, canola oil levels declined with increasing N. Usually canola oil yields peak with seed yield, but excessive N will suppress oil content and oil yield.

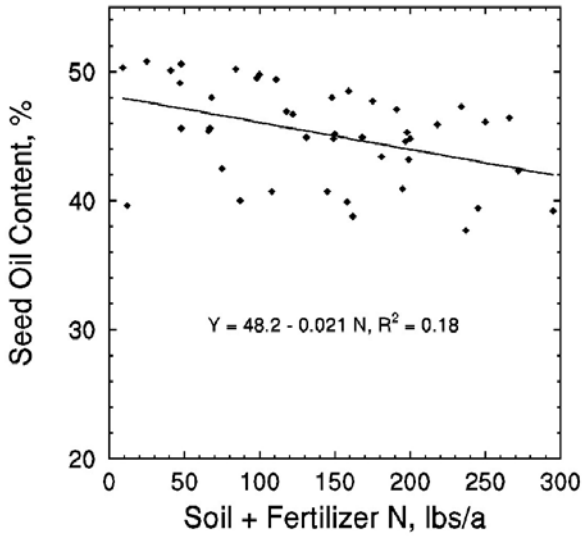

Figure 2. Effect of available N on spring canola oil content.

As found with many crops in Montana, canola response to P is highly variable. The thirteen location-years of data in this summary is not enough for determining a reliable critical level for P. For example, a P response occurred when soil P was very high (32 ppm), and did not respond when soil P was 12 ppm. A preliminary analysis of the canola P response data suggests the critical level of soil P for canola is 21 ppm. Most P responses were with 20 to 30 lbs P2O5/a. Canola growers may apply 20 to 30 lbs P2O5/a with the seed when soil P is less than or equal to 21 ppm, and about 10 to 15 lbs P2O5/a when the P soil test exceeds 21 ppm. Canola does not usually respond to high rates of P because it is very effective in utilizing indigenous soil P.

Only a couple of experiments evaluated K fertilizers, and the results were inconclusive. However, based on K response by other crops in Montana, growers may want to include 15 to 30 lbs K2O in their canola fertilizer program.

Sulfur nutrition is very important in canola fertilizer programs and often interacts with N. In general, agronomists recommend N:S ratios of 7:1 when applying fertilizer or evaluating soil and plant tissue tests. However in Montana, soil S can be very high in the 0 to 36 inch soil depth, and the crop may still respond to S fertilization. About half of all S experiments have responded to S. It appears soil S (0-12 in. soil depth) is useful in predicting S fertilizer response. However only nine locations were available for evaluation because in the early S experiments, S soil tests were only done on the surface soil sample (0-6 in. depth). Data from these limited experiments indicate S soil test critical level to be about 90 lbs S/a triggering a S fertilizer recommendation of 20 lbs S/a.

Fertilizer Facts:

- For optimum yields, canola requires about 3.5 to 4 lbs of N/bu
- P fertilizer at 20 to 30 lbs P2O5/a when soil P <21 ppm and 10 to 15 lbs P2O5/a when soil P >21 ppm may be beneficial
- Though K fertilizer research is lacking, producers may benefit from 15 to 30 lbs K2O/a
- Add 20 lbs S/a when the S soil test from 0-12 in. of soil is 90 lbs/a or less

Edited by Jeff Jacobsen, Extension Soil Scientist