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CANOLA CANADA
CANOLA COUNCIL OF CANADA

CANOLA ADVANTAGE

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Plant Populations for Profitability

Growers must pay careful attention to plant populations in order to maximize yield potential of canola varieties. Crops with low plant densities are forced to compensate through increased pod and seed production per plant and are more vulnerable to losses from diseases, insects, weed competition and environmental stresses such as frost.

The Canola Growers Manual (pgs 807-810) suggests that ideal plant populations range from 7-14 plants/ft^2. At any set seeding rate (lb/ac), only a percentage of seeds will emerge to produce viable plants. The typical average for emergence is around 50% but this can fluctuate depending on field conditions. The plant population produced will also be greatly affected by seed size, measured as thousand seed weight (TSW) in grams, because this dictates the number of seeds actually planted for a given seeding rate.

The following tables demonstrate the impact that TSW and % survival can have on canola plant densities, for a variety of seeding rates. The shaded areas in the tables would represent plant populations sufficient to ensure optimum yields.

Estimated Plant Populations Under Various Seeding Conditions

Table 1: Plants Per Square Foot Under Good Seeding Conditions
Seed Survival = 75%

Thousand Seed Weight (grams)	Seeding Rates (lb/ac)				
	3	4	5	6	7
2.5	9.4	12.5	15.6	18.8	21.9
3	7.8	10.4	13.0	15.6	18.2
3.5	6.7	8.9	11.2	13.4	15.6
4	5.9	7.8	9.8	11.7	13.7
4.5	5.2	6.9	8.7	10.4	12.2
5	4.7	6.3	7.8	9.4	10.9
5.5	4.3	5.7	7.1	8.5	9.9
6	3.9	5.2	6.5	7.8	9.1

Table 2: Plants Per Square Foot Under Average Seeding Conditions
Seed Survival = 50%

Thousand Seed Weight (grams)	Seeding Rates (lb/ac)				
	3	4	5	6	7
2.5	6.3	8.3	10.4	12.5	14.6
3	5.2	6.9	8.7	10.4	12.2
3.5	4.5	6.0	7.4	8.9	10.4
4	3.9	5.2	6.5	7.8	9.1
4.5	3.5	4.6	5.8	6.9	8.1
5	3.1	4.2	5.2	6.3	7.3
5.5	2.8	3.8	4.7	5.7	6.6
6	2.6	3.5	4.3	5.2	6.1

Table 3: Plants Per Square Foot Under Poor Seeding Conditions
Seed Survival (%) = 25%

Thousand Seed Weight (grams)	Seeding Rates (lb/ac)				
	3	4	5	6	7
2.5	3.1	4.2	5.2	6.3	7.3
3	2.6	3.5	4.3	5.2	6.1
3.5	2.2	3.0	3.7	4.5	5.2
4	2.0	2.6	3.3	3.9	4.6
4.5	1.7	2.3	2.9	3.5	4.1
5	1.6	2.1	2.6	3.1	3.6
5.5	1.4	1.9	2.4	2.8	3.3
6	1.3	1.7	2.2	2.6	3.0

Use the above tables as a guideline to determine the appropriate seeding rate for your field conditions, or calculate the required rate yourself using the following formula:

Seeding Rate (lb/ac) = [9.6 x desired plant density (plants/ft^2) x TSW (grams)] ÷ estimated seed survival (%, expressed as a whole #)

An example
TSW of 4.0 grams, desired plant population of 10 plants/ft^2, 50 % estimated seed survival

(9.6 x 10 plants/ft^2 x 4.0 g) ÷ 50 = 7.7 lbs/ac

Estimating the percentage of seed that will survive to produce viable plants is a challenge. Survival can vary from field to field and from one season to the next. As mentioned, the average survival rate is about 50 %, but this can easily vary from 25-75%. The percent survival will depend upon many factors including seed size, seed germination %, seedling vigor, seed chlorophyll, variety selection (e.g. hybrid vs. open pollinated), soil temperatures, amount of fertilizer with the seed, soil moisture, planting depth, soil types, type of machinery (amount of soil disturbance, type and amount of packing), seeding speed, crop and herbicide rotation (disease), straw management, and insect pests.

Most factors can be managed to maximize seed and seedling survival. Refer to Canol@Fact "Factors affecting canola survival from seeding to 21days after emergence" for more details. Check Growing Canola at http://www.canola-council.org.

Once the appropriate seeding rate has been determined, ensure the seeding equipment is properly calibrated to deliver the desired pounds of seed per acre. Consult the operator's manual for recommended calibration instructions, or follow the following procedure:

1. Measure out 30.5 m (100 ft)
2. Collect the seed from several drill runs over this distance determine the total weight in grams or ounces.
3. Calculate the seeding rate

Grams of seed ÷ # of drill runs ÷ row spacing (inches) x 12=seeding rate (lbs/ac)

or

Ounces of seed ÷ # of drill runs ÷ row spacing (inches) x 342=seeding rate (lbs/ac)

or

Grams of seed ÷ # of drill runs ÷ row spacing (cm) x 34.14 = seeding rate (kg/ha)

For example:
collected 18.75 g or 0.65 oz from 5 drill runs

Sample calculations:
18.75 g ÷ 5 drill runs ÷ 9" row spacing x 12 = 5.0 lbs/ac

0.65 oz ÷ 5 drill runs ÷ 9" row spacing x 342 = 5.0 lbs/ac

18.75 g ÷ 5 drill runs ÷ 22.9 cm row spacing x 34.14 = 5.6 kg/ha

Adjust the seeder and recalibrate until the target seeding rate is achieved. Then be sure to record the drill settings, as well as the TSW and seeding rate.

Finally, follow up after seeding with plant counts to determine what population was actually achieved. At approximately 21 days after emergence, or when assessing a field for the timing of the first application of herbicide, record plant populations in various parts of the field. Use that information to calculate the survival percentage. For example, if the field was seeded at 5 lbs/ac and the thousand seed weight was 3grams/thousand seeds, 100% survival would produce 17 plants/ft^2. However, if only 8 plants/ft^2 are counted this means only about 50 % actually survived.

What is the impact of canola plant population on yield and quality?

Over a period of three years, the Canola Council of Canada through its Canola Production Centre program examined interactions between seeding rates and dates, plant populations produced and how those populations were affected by disease, insects and environment. The results demonstrate the benefits of good plant populations and also show that low plant densities can produce viable crops. However, the management of thin stands is more challenging, due to more variable maturity and lower tolerance for additional plant losses.

The Council trials examined results of seeding a hybrid canola variety at 3 seeding rates (1 lb/ac, 3 lb/ac, 5 lbs/ac) seeded at early and normal planting dates. "Early" was typically when seeding allowed, while "normal" was when area producers were seeding. The trials were seeded with Hoe press drills on 7-9" spacing with 1" openers and on row packing.

Table 1 shows the average yield and contribution margin over 3 years encompassing all yield and price variation, as well as cost differences among treatments.

Table 1 Canopy Manipulation Trial Results (average of all sites)

Seeding Rate	Plants/ft²	Yield (bu/ac)	Contribution Margin	Average Maturity (Days)	Range Maturity (Days)
Early Planting date					
1lb/ac	2.0	30	90	103	84-122
3lb/ac	5.0	35	123	99	82-113
5lb/ac	8.0	37	126	98	82-113
Normal Planting date					
1lb/ac	2.8	31	102	100	81-114
3lb/ac	5.9	36	136	98	81-113
5lb/ac	9.5	37	130	97	80-111

Looking at the contribution margin results, the advantage of having at least 5-6 plants/ft² was about $33.00/acre over plant stands that averaged 2-3 plants/ft². Stands with lower plant populations took longer to mature, however maturity was not a factor at most of these sites due to the fall weather conditions and long frost free periods when the trials were conducted. If the fall season is short, cool or wet conditions will slow crop development. The additional delay in maturity from lower plant densities would increase risk of grade and/or yield losses in the fall due to late season frosts or other stresses.

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