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Three Year Summary of Production Practices Used by Growers Participating in the Flax Yield Contest

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Ervin A. Oelke, Extension Agronomist
University of Minnesota, St. Paul

Under the sponsorship of the Flax Development Committee of the Flax Institute of the United States, a total of 218 completed forms were returned by growers over a three year period (68-70). These forms indicated the yield obtained from 5 to 6 acres of flax and the production practices that were used. There were 131 growers from North Dakota, 51 from South Dakota and 37 from Minnesota that completed forms. Some growers entered the contest all three years.

In 1968 the average yield for all growers was 22.6 bushels per acre representing an increase of 138 percent over the 10 year county average (9.5). In 1969 the growers averaged 22.2 bushels per acre representing an increase of 150 percent over the 10 year county average (8.0). In 1970 the average yield for all growers was 20.9 bushels per acre while the 10 year county average was 9.9. This was an increase of 110 percent.

The production practices used by all growers were punched onto cards and the computer was instructed to calculate the frequency distribution of specific production practices used by growers. The growers in the Northern, Central and, Southern flax area were divided into four yield groups and the frequency data (percent of growers using a specific production practice) calculated for each group.

AREA I PRODUCTION PRACTICES

The first set of tables (1-9) gives frequency data for the Northern area which consists of counties in North Dakota and Minnesota that are north of a line connecting the southern boundaries of McLean County, North Dakota and Mahnomen County, Minnesota.

There were 24 growers in group 1 (25 bushels per acre or more), 24 in group 2 (20-24.9 bushels per acre), 26 in group 3 (15-19.9 bushels per acre), and 6 in group 4 (below 15 bushels per acre). Frequency data are given only for those production practices which tended to differ with yield levels. The numbers given in each table represent the percen of growers using a particular production practice.

Soil description and cropping history

A few more growers in the top group said they had heavy soils, however, 70-80% in all groups said they had medium soils.

About the only relationship of cropping history to yield was that 29% of the growers in the top group followed fallow, while none did in the lowest group. About 68% of all the growers had a cereal grain before flax.

Table 1. Crop preceding flax.

	Yield (bu/A)			
Crop	25+ above	20-24.9	15-19.9	Below 15
Cereal grain	67*	62	77	67
Flax	-	4	-	17
Fallow	29	8	8	-
Hay or pasture	4	8	12	17
Corn	-	4	4	-
Soybeans	-	4	-	-
Other	-	8	-	-

* Percent of growers

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Table 2. Varieties used by the four yield level groups.

Variety	Yield (bu/A) 25+ above	20-24.9	15-19.9	Below 15
B-5128	8	-	4	17
Bolley	29	50	38	33
Summit	29	25	19	33
Windom	21	12	12	-
Redwood	-	4	4	-
Nored	4	4	8	17
Others	8	4	16	-

Table 3. Fungicide seed treatment.

Yield (bu/A)	No	Yes
25+ above	12	88
20-24.9	8	91
15-19.9	38	62
Below 15	50	50

Table 4. Type of fall tillage

Yield (bu/A)	None	Plow	Disc	Cultivator
25+ above	8	46	8	38
20-24.9	4	71	8	17
15-19.9	12	50	8	31
Below 15	33	17	-	50

Table 5. Nitrogen applied in spring before seeding.

Yield (bu/A)	None	1-15	16-25	26-35
25+ above	83	4	-	13
20-24.9	96	-	4	-
15-19.9	89	4	-	7
Below 15	100	-	-	-

Table 6. Nitrogen applied with seed.

Yield (bu/A)	lb/A None	1-15	16-25	26-35
25+ above	71	26	4	-
20-24.9	88	4	4	4
15-19.9	96	-	-	4
Below 15	100	-	-	-

Table 7. Grass herbicide used.

Yield (bu/A)	Kind None	TCA	Dalapon	Diallate	Barban
25+ above	71	-	25	-	4
20-24.9	84	-	8	8	-
15-19.9	88	-	8	4	-
Below 15	83	17	-	-	-

Table 8. Swathing date grouped by two week intervals.

Yield (bu/A)	Date Aug. 1-15	Aug. 16-30	Sept. 1-15	Sept. 16-30	Oct. 1-15	Oct. 16-31	Blank
25+ above	-	4	21	21	17	12	25
20-24.9	4	8	29	29	17	8	4
15-19.9	4	15	31	15	12	-	23
Below 15	-	-	50	-	33	-	17

Table 9. Grower estimations of stored soil moisture in the spring and of rainfall and temperature during the growing season.

Yield (bu/A)	High		Medium	Low
		Stored Moisture		
25+ above	54		42	4
20-24.9	29		54	17
15-19.9	46		23	31
Below 15	-		83	17
		Rainfall		
25+ above	67		29	4
20-24.9	67		29	4
15-19.9	50		38	12
Below 15	50		50	-
		Temperature		
25+ above	12		50	38
20-24.9	12		58	29
15-19.9	8		65	27
Below 15	17		50	33

Seed used

There was little difference in the type of seed used by the four yield groups. About 80% of all the growers used non-certified seed, while 10% used registered seed. Germination percent averaged 93% for all growers, with little variation between groups. Percent purity averaged 97 for all the growers.

Bolley, Summit and Windom were the most popular varieties with Windom used more by the top group. Nearly all of the seed was cleaned by an elevator or cleaning plant.

About 90% of the top two groups used a fungicide seed treatment while only 50% of the growers in the low yield group treated their seed.

Seedbed preparation

More growers (92%) in the top group worked their fields in the fall compared to 77% for the low group. There was also a tendency for the two higher yielding groups to go over their fields more than the low group. Very few growers in any group applied fall fertilizer.

Most (80%) of the growers in all groups used a field cultivator for the first operation and a harrow for the second operation. Again the higher yielding groups went over their fields more often. None of the growers in the low group applied broadcast fertilizer in the spring while 17% in the high group applied an average of 24 pounds per acre of nitrogen. Also, about 5% applied phosphorus and potassium in the high group while none did in the low group.

Seeding operations

The average seeding date for the top group was 6 days later than for the low group. It was also later than the two intermediate yield groups.

The seeding rate for the two top groups averaged about 3 pounds per acre higher than the two bottom groups. The average rate for the top group was 44 pounds.

There was a definite trend for the higher yielding growers to use fertilizer with the seed. This was especially true for nitrogen, but also for phosphorus and potassium. The average rate was 10 pounds per acre for nitrogen, 24 pounds for P_2O_5 and 5 pounds for K_2O for the top group.

The average seeding depth was slightly less (1.2 in.) for the top group compared to the lower three groups (1.5 in.).

After seeding operations

No trend was evident in broadleaf herbicide usage; about 45% used one. A few more growers in the top group used a grass herbicide (30%) compared to 17% in the low group.

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Harvest operations

Swathing date was later (7 days) for the top group compared to the low group. Threshing date was only about 1 day later. The average swathing date for the top group was September 26, while the threshing date was October 5.

Growing season conditions

More growers (54%) in the top group said they had high stored moisture in the spring, while none indicated this in the lowest yield group.

A few more growers in the top two groups also indicated they had high rainfall during the growing season.

No growers in the low yield group said they had diseases while about 20% in the top three groups said they had some diseases. The most common was pasmo.

AREA II PRODUCTION PRACTICES

The central area includes the counties of Burleigh and Emmons and those directly east of these two in North Dakota and the counties of Clay, Wilkin, Becker and Ottertail in Minnesota.

There were 23 growers with yields of 24 bushels per acre or above (group 1), 19 growers with yields of 19-23.9 bushels per acre (group 2), 20 growers with yields of 15-18.9 bushels per acre (group 3) and 10 growers with yields below 15 bushels per acre (group 4).

Tables 10 through 18 give the frequency data for the production practices which differ somewhat between groups.

Table 10. Crop preceding flax.

	Yield (bu/A)			
Crop	24+ above	19-23.9	15-18.9	Below 15
Cereal grain	30	63	45	60
Flax	4	11	15	-
Fallow	13	-	5	-
Hay or pasture	30	16	15	-
Corn	13	5	-	10
Soybeans	-	-	5	-
Other	9	5	15	30

Table 11. Classification of seed used by growers.

Yield (bu/A)	Registered	Certified	Non-certified	Blank
24+ above	22	4	74	-
19-23.9	11	16	74	-
15-18.9	5	15	75	5
Below 15	-	20	70	10

Table 12. Varieties used by the four yield level groups.

	Yield (bu/A)			
Variety	24+ above	19-23.9	15-18.9	Below 15
B-5128	4	-	-	20
Bolley	52	37	60	20
Summit	17	21	10	10
Windom	9	16	15	20
Nored	4	11	5	10
Noralta	-	11	5	20
Others	12	5	5	-

Table 13. Fungicide seed treatment.

Yield (bu/A)	No	Yes
24+ above	22	78
19-23.9	47	52
15-18.9	35	65
Below 15	55	45

Table 14. Type of fall tillage.

Yield (bu/A)	None	Plow	Disc	Cultivator
24+ above	13	61	17	9
19-23.9	16	53	-	32
15-18.9	30	45	-	25
Below 15	20	50	-	30

Table 15. Nitrogen applied in spring before seeding.

	lb/A				
Yield (bu/A)	None	1-15	16-25	26-35	45+
24+ above	74	-	18	4	4
19-23.9	95	-	5	-	-
15-18.9	90	-	-	-	10
Below 15	100	-	-	-	-

Table 16. Nitrogen applied with seed.

	lb/A				
Yield (bu/A)	None	1-15	16-25	26-35	36-45
24+ above	52	42	-	6	-
19-23.9	79	16	-	-	5
15-18.9	80	15	-	-	5
Below 15	90	10	-	-	-

Table 17. Swathing date grouped by two week intervals.

	Date					
Yield (bu/A)	Aug. 1-15	Aug. 16-31	Sept. 1-15	Sept. 16-30	Oct. 1-15	Blank
24+ above	14	61	13	4	4	4
19-23.9	21	21	43	10	-	5
15-18.9	20	40	20	15	5	-
Below 15	30	30	-	10	20	10

Table 18. Grower estimations of stored soil moisture in the spring and of rainfall and temperature during the growing season.

Yield (bu/A)	High		Medium	Low
		Stored Moisture		
24+ above	39		48	13
19-23.9	26		53	21
15-18.9	30		45	25
Below 15	20		50	30
		Rainfall		
24+ above	35		57	9
19-23.9	42		42	16
15-18.9	30		45	25
Below 15	20		40	40
		Temperature		
24+ above	9		74	17
19-23.9	21		63	16
15-18.9	15		70	15
Below 15	40		40	20

Soil description and cropping history

Most growers in all groups described their soils either as medium (75%) or heavy (25%).

Fewer growers in the top yield group (30%) followed a cereal grain with flax compared to 60% in the lowest yield group, but more followed hay or pasture (30%) in the highest group, while none did in the lowest group.

There was no relationship of soil erosion to yield. About 53% in all groups had field shelterbelts.

Seed used

About 75% of the growers in all groups used non-certified seed, however, 22% of the growers in the top group used registered seed while none used registered seed in the lowest yield group.

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The four most popular varieties for all yield groups were Nored, Bolley, Summit and Windom. No trend was evident.

Most of the growers had their seed cleaned by an elevator, cleaning plant or the seller. No trend was evident.

Seed treatment with a fungicide was more common among the top yield group, 78% of them treated their seed, while only 45% treated their seed in the lowest yield group.

Seedbed preparation

There was slightly more fall plowing done by the top yielding group than by the lowest group. No group applied much fertilizer in the fall.

About 20% plowed, 35% disked and 40% cultivated their fields as the first operation in the spring. This was true for all yields groups. A number of the growers in the top yield group (26%) applied fertilizer in the spring before seeding while none did in the low group. Most of the growers that applied fertilizer as a broadcast application in the spring used only nitrogen; the average rate being 27 pounds per acre.

Seeding operations

About 65% of the growers in this area seeded during the month of May with little difference between groups. The average seeding rate was 45 pounds per acre for all groups.

A much higher percentage of the growers in the top group applied fertilizer with the seed than the growers in the last three groups. About 48% of the growers in the top group applied nitrogen, 44% applied phosphorus and 26% applied potassium. Only 10% in the low yield group applied nitrogen and phosphorus and none applied potassium. The average rate of nitrogen was 9 pounds per acre, while it was 17 for P_2O_5 and 5 for K_2O.

After seeding operations

There was no difference in the percent of growers that used herbicides. About 55% of all the growers used a broadleaf herbicide and 10% used a grass herbicide.

Even though the seeding dates weren't different for the yield groups, the average swathing date for the top group was 3 days earlier than the second group, 4 days earlier than the third group and 5 days earlier than the last yield group. Threshing dates averaged 10 days earlier for the top group than for the low yield group.

Growing season conditions

More growers (39%) in the top group indicated having high stored moisture in the spring than for the low group (20%). Only 9% in the high group said they had low rainfall while 40% indicated this for the low yield group.

Since temperatures are often related to cloud cover, only 9% of the growers in the top group said they had high temperatures while 40% had high temeratures for the low yield group which had less rainfall.

About 75% of the growers in all groups indicated they had no disease problems.

AREA III PRODUCTION PRACTICES

Area III consisted of 12 counties in northeastern South Dakota (McPherson, Brown, Marshall, Roberts, Day, Grant, Clark, Codington, Deuel, Hamlin, Kingsbury, Brookings) and 12 counties just east of these in Minnesota (Traverse, Grant, Douglas, Big Stone, Stevens, Pope, Swift, Chippewa, Lac qui Parle, Yellow Medicine, Lincoln, and Lyon).

There were 13 growers in group 1 (29 bushels per acre or more), 20 growers in group 2 (25-28.9 bushels per acre), 20 growers in group 3 (20-24.9 bushels per acre) and 13 growers in group 4 (below 20 bushels per acre).

Tables 19 through 27 give the frequency data for the production practices which changed somewhat between yield groups.

Table 19. Crop preceding flax.

Crop	Yield (bu/A) 29+ above	25-28.9	20-24.9	Below 20
Cereal grain	31	30	50	46
Flax	8	-	5	8
Fallow	-	15	5	8
Hay or pasture	-	-	10	30
Corn	23	30	25	-
Soybeans	31	15	5	8
Other	8	10	-	-

Table 20. Classification of seed used by growers.

Yield (bu/A)	Registered	Certified	Non-certified
29+ above	31	31	38
25-28.9	15	15	70
20-24.9	5	20	75
Below 20	8	15	77

Table 21. Varieties used by the four yield level group.

Variety	Yield (bu/A) 29+ above	25-28.9	20-24.9	Below 20
B-5128	15	5	5	8
Bolley	8	10	10	8
Summit	15	15	50	46
Windom	23	15	20	8
Redwood	-	15	-	-
Norstar	15	5	-	8
Nored	10	15	15	15
Others	8	20	-	8

Table 22. Type of fall tillage

Yield (bu/A)	None	Plow	Disc	Cultivator
29+ above	8	77	8	8
25-28.9	20	25	35	20
20-24.9	20	55	10	15
Below 20	15	62	8	15

Table 23. Nitrogen applied in the fall.

Yield (bu/A)	lb/A None	1-15	16-25	26-35	26-45	45+
29+ above	69	-	8	8	-	15
25-28.9	95	-	-	-	5	-
20-24.9	80	5	5	10	-	-
Below 20	92	-	-	8	-	-

Table 24. Seeding date grouped by two week intervals.

Yield (bu/A)	April 1-15	April 16-30	May 1-15	May 16-31	June 1-15
29+ above	8	46	31	15	-
25-28.9	-	15	65	20	-
20-24.9	5	15	50	25	5
Below 20	8	31	39	22	-

Table 25. Use of herbicides.

Yield (bu/A)	Broadleaf No	Broadleaf Yes	Grass No	Grass Yes
29+ above	8	92	54	46
25-28.9	20	80	65	35
20-24.9	25	75	80	20
Below 20	30	70	92	8

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Table 26. Swathing date grouped by two week intervals.

Yield (bu/A)	Aug. 1-15	Aug. 16-31	Sept. 1-15
29+ above	38	62	-
25-28.9	40	45	15
20-24.9	35	55	10
Below 20	46	46	8

Table 27. Grower estimations of stored soil moisture in the spring and rainfall and temperature during the growing season.

Yield (bu/A)	High		Medium	Low
		Stored		
29+ above	54	Moisture	31	15
25-28.9	45		30	25
20-24.9	40		35	25
Below 20	15		62	23
		Rainfall		
29+ above	31		69	-
25-28.9	25		40	35
20-24.4	40		45	15
Below 20	-		46	54
		Temperature		
29+ above	-		71	23
25-28.9	10		65	25
20-24.4	15		50	35
Below 20	31		54	15

Soil description and cropping history

Most growers (82%) in all four groups described their soils as medium, while the remainder described them as heavy.

Fewer growers in the top two yield groups followed a cereal grain than the lower two yield groups. However, 54% in the top group followed corn or soybeans while only 8% did in the low group. About 46% of the growers in the top group had a cereal grain crop 4 years ago while only 23% did in the low yield group. No trends were evident for the preceding 2 and 3 years before flax.

No trends were evident for soil erosion management.

Seed used

More growers (62%) used either registered or certified seed in the top group compared to the low group (23%).

Average germination was about the same (95%) for all groups while purity of the seed was slightly higher for the top group (99%) compared to an average of (95%) for the other three groups.

All of the growers in the top group had their seed cleaned by someone else (elevator, cleaning plant or seller), while 20% in the three lower groups cleaned their own seed. About 35% of the growers in all groups treated their seed with fungicides.

The variety Summit, was used by about 50% of the growers in the 2 lower groups, while only 15% used this variety in the top 2 groups.

Seedbed preparation

Fall tillage was common for all groups, however, the top group had only 7% that didn't fall till, while this was true for 20% in the other 3 groups. Also those in the high group that worked their fields in the fall, 80% plowed while the lower groups plowed 47% of the time.

Application of fertilizer in the fall was more common among the high group (30%), than with the other three groups (5-20%). The average rate of nitrogen applied was 47 pounds per acre. One grower felt that plowing down the fertilizer in the fall was the best for flax.

No trend in the type of spring tillage was evident except more spring plowing was done by the lower three groups. A field cultivator or disc was used by about 60% of the growers in all groups as the first spring operation.

Spring fertilizer before planting was not common. Only 20% of the growers did this; the low group had a slightly lower percent than the top group.

Seeding operations

The average seeding date was 2 to 6 days earlier for the top group than the other three groups. Most (75%) of the flax in this area was planted before May 15 during the last 3 years.

The average seeding rate was 56 pounds for the top group and 51 pounds for the other three groups. About 23% of the top growers used more than one bushel per acre while only 8% did so in the low group.

There was little difference among the four groups in the percent of growers that used fertilizer with the seed. About 30% used nitrogen and phosphorus and 15% used potassium. The average rate per acre used was 10 pounds of nitrogen, 15 pounds of P_2O_5 and 7 pounds of K_2O.

The average indicated seeding depth was 1.2 inches for all groups with most of the drills being of the press type.

As the yield went up, the percent of growers using a broadleaf herbicide also went up, 8 to 30%. This was true for grass herbicides also, 8 to 46%.

No growers used insecticides.

Harvest operations

The swathing date averaged 2 to 3 days earlier for the top group than for the other three groups. The average date for the top group being August 17. There was a tendency for the top group to swath on the early side, 38% said this for the top group while only 8% said this for the low group.

Threshing date averaged 2 to 6 days earlier for the top group. All in the top group threshed before August 31, while 25% of the other three groups threshed later than this.

Growing season conditions

More than half (54%) of the growers in the top group said they had high stored moisture in the spring, while only 15% said this in the low group. None of the growers in the top group said they had low rainfall during the growing season, while 54% in the low group said they had low rainfall.

Temperatures apparently were cooler for the top growers since none indicated high temperatures, while 31% in the low group said they had high temperatures. Ninety percent of all the growers said they had no diseases.