

FERTILIZER USE IN WESTERN CANADA

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Maintenance of favorable soil fertility levels and correction of growth limiting nutrient deficiencies are essential practices for achieving and sustaining high levels of agricultural production. The western Canadian fertilizer industry has a vital role in supplying fertilizer materials and services to the farmers of western Canada. The objective of this paper is to identify and describe some of the important developments occurring in the fertilizer business in western Canada.

Capacities for production of N, P₂O₅ and K₂O in western Canada are shown in Table 1. Of particular interest is the more than two-fold expansion in nitrogen fertilizer capacity which took place between 1975 and 1977. Phosphorus production capabilities have changed only slightly since 1970. The current total rated capacity of Saskatchewan's 10 potash mines is approximately 8.3 million tons.

Table 1: Fertilizer Production Capacity in Western Canada for Selected Years Between 1950 and 1977.

ANNUAL PRODUCTION CAPACITY

(000's in Short Tons)

Year	N	P ₂ O ₅	K ₂ O
1949/50	279	86	-
1959/60	457	275	-
1969/70	772	525	7772
1974/75	772	525	8324
1976/77	1972	575	8324

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For maximum efficiency of these fertilizer operations they should operate as close as possible to 100% of their rated capacities. Domestic consumption of N and P fertilizers has up until the last few years accounted for only a minor proportion of the western Canadian production capacity. To operate efficiently it has been necessary to export surplus production, mainly to adjoining areas in the United States.

Fertilizer use in western Canada, particularly in Saskatchewan, has historically been subject to wide fluctuations. One of the major challenges to the fertilizer industry has been to anticipate sudden swings in consumption and to stabilize the industry by orderly export of surplus production. During the world-wide shortage of fertilizer supplies in 1974 and 1975, the western Canadian fertilizer industry had the added responsibility of satisfying domestic requirements in spite of much more lucrative export markets.

Shipments of fertilizers in the provinces of Alberta, Saskatchewan and Manitoba during the period 1974-1978 have ranged from about 1.19 to 1.75 million tons annually (Table 2). During these five years Saskatchewan usage has represented from 22 to 27 per cent of consumption in the Prairies.

Table 2: Fertilizer Shipments in the Prairie Region, 1974-1978

FERTILIZER SHIPMENTS		
(000's in Short Tons)		
<u>Year</u>	<u>Prairie Region</u>	<u>Percent in Saskatchewan</u>
1973/74	1188	22
1974/75	1288	24
1975/76	1191	23
1976/77	1314	22
1977/78	1747	27

A comparison of the proportion of fertilizer consumption in each of the Prairie Provinces is made in Table 3. Alberta ranks first in fertilizer use followed closely by Manitoba.

Table 3: Proportion of Fertilizer Consumption in Each of the Prairie Provinces, 1974-1978

Percentage Consumption			
<u>Year</u>	<u>Alberta</u>	<u>Sask.</u>	<u>Manitoba</u>
1973/74	47	22	31
1974/75	46	24	30
1975/76	48	23	29
1976/77	49	22	29
1977/78	44	27	29

Nitrogen use in the four western provinces reached a record high of just under 530,000 tons in 1978 (Table 4). The 1978 consumption of almost 357,000 tons of P_2O_5 was also a new high in our region.

By comparing the plant nutrient consumption values in Table 4 with the production capacities noted in Table 1, it can be seen that domestic usage of N and P_2O_5 in 1978 was equivalent to 27 and 62 per cent, respectively of the production capacities. Consumption of 35,000 tons of K_2O is extremely small in relation to the production capability of over 8.3 million tons.

Table 4: Consumption of Plant Nutrients in Western Canada 1974-1978

PLANT NUTRIENT CONSUMPTION			
(000's in Short Tons)			
<u>Year</u>	<u>N</u>	<u>P_2O_5</u>	<u>K_2O</u>
1973/74	326.2	319.5	9.9
1974/75	363.1	342.3	17.0
1975/76	398.5	303.3	19.7
1976/77	406.3	279.1	28.7
1977/78	529.5	356.6	35.0

Quantities of the three plant nutrients used in Saskatchewan during 1974-78 are shown in Table 5. The doubling of N use between 1974 and 1978 is rather striking and one wonders what lies ahead now that the Saskatchewan Soil Testing Laboratory is endorsing higher N recommendation rates and promoting custom soil sampling. In addition, the introduction of a comprehensive grading system with adequate incentives for producing high protein wheat should have a strong positive effect on growth of N use in the province, as well as elsewhere in the Prairies.

Table 5: Consumption of Plant Nutrients in Saskatchewan, 1974-1978.

PLANT NUTRIENT CONSUMPTION

(000's in Short Tons)

Year	N	P ₂ O ₅	K ₂ O
1973/74	54.4	103.7	0.7
1974/75	61.4	117.4	0.6
1975/76	56.4	89.3	0.8
1976/77	66.6	83.6	1.2
1977/78	111.2	121.7	0.7

The proportion of each of the three nutrients consumed in Saskatchewan can be compared in Table 6. Saskatchewan accounts for more P₂O₅ use than it does for N.

Table 6: Proportion of Plant Nutrients Consumed in Saskatchewan, 1974-1978

PERCENTAGE
PLANT NUTRIENT CONSUMPTION

Year	N	P ₂ O ₅	K ₂ O
1973/74	16.7	32.5	7.1
1974/75	16.9	34.3	3.5
1975/76	14.2	29.4	4.1
1976/77	16.4	30.0	4.2
1977/78	21.0	34.1	2.0

Popularity of anhydrous ammonia has been increasing rapidly since the early 1970's and continuation of this trend is clearly evident in Table 7. During the years 1974 to 1978 there was a 2.7 fold increase in the Prairie Region while at the same time in Saskatchewan use of this N source increased nearly 18 times. The large increase in NH₃ production capacity, from about 800,000 tons annually in the early 1970's to slightly more than two million tons in 1977, has undoubtedly contributed greatly to this rapid expansion in use. After allowing for the amounts of NH₃ used in the manufacture of other fertilizers, there is an estimated 600,000 to 700,000 tons available for direct application, export, and industrial uses.

Table 7: Consumption of Anhydrous Ammonia in the Prairie Region and Saskatchewan, 1974-1978

ANHYDROUS AMMONIA CONSUMPTION		
(000's in Short Tons)		
<u>Year</u>	<u>Prairies</u>	<u>Saskatchewan</u>
1973/74	79	1.4
1974/75	82	1.4
1975/76	106	4.3
1976/77	152	12.0
1977/78	210	25.0

Although there was a dramatic rise in NH₃ usage in Saskatchewan in the five years being considered, Alberta used by far the greatest proportion of this N source (Table 8). One factor greatly favoring NH₃ use in Alberta is the proximity of manufacturing plants to prime marketing areas. Much of the NH₃ use takes place within relatively efficient truck hauling distances of about 200 miles from the points of production.

Table 8: Proportion of Anhydrous Ammonia Consumption in Each of the Prairie Provinces, 1974-1978

ANHYDROUS AMMONIA			
Percentage Consumption			
<u>Year</u>	<u>Alberta</u>	<u>Sask.</u>	<u>Manitoba</u>
1973/74	70.0	1.9	28.1
1974/75	80.4	2.1	17.6
1975/76	72.9	3.3	23.8
1976/77	71.9	7.3	20.8
1977/78	61.9	11.7	26.4

Accompanying the rising popularity of NH_3 there has also been a very significant increase in urea consumption (Table 9). Between 1974 and 1978 there was a four-fold increase in usage of urea in the Prairie Provinces. During the same period use of this N fertilizer in Saskatchewan increased by a factor of about 11 times.

Urea production capacity in western Canada in 1975 was approximately 215,000 tons/year, and on completion of two new world scale plants in Alberta it now stands at about 1,200,000 tons annually or an expansion of more than 450 percent. This large production capability has undoubtedly exerted considerable competitive pressure on other dry fertilizer sources of N. Some agriculturists initially had reservations about the use of urea because of several agronomic considerations. Experience in the use of urea and greater understanding of its behaviour in soil, however, have resulted in soil fertility management practices for obtaining full benefits from urea fertilization.

Table 9: Consumption of Urea in the Prairie Region and Saskatchewan, 1974-1978

UREA CONSUMPTION		
(000's in Short Tons)		
<u>Year</u>	<u>Prairies</u>	<u>Saskatchewan</u>
1973/74	58	4.7
1974/75	87	7.5
1975/76	98	9.0
1976/77	144	22.3
1977/78	234	53.4

Alberta's prominence as a consumer of urea has declined during the past five years, and now Manitoba's share of the urea market is not far behind that of Alberta's (Table 10). The percentage of urea consumption taking place in Saskatchewan has more than doubled since 1974.

Table 10: Proportion of Urea Consumption in Each of the Prairie Provinces, 1974-1978

UREA			
<u>Percentage Consumption</u>			
<u>Year</u>	<u>Alberta</u>	<u>Sask.</u>	<u>Manitoba</u>
1973/74	68.7	9.6	21.7
1974/75	60.5	8.4	31.1
1975/76	54.4	12.0	33.6
1976/77	47.0	15.5	37.5
1977/78	41.1	22.5	36.4

Between 1974 and 1976 there was an increase in ammonium nitrate consumption in the Prairies but since then its use seems to have declined slightly, probably because of the strong competition from urea which was mentioned earlier (Table 11). Use of this N source in Saskatchewan has gradually increased each year since 1974 and now about 25% of Prairie Province consumption of ammonium nitrate occurs in Saskatchewan.

Table 11: Consumption of Ammonium Nitrate in the Prairie Region and Saskatchewan, 1974-1978

AMMONIUM NITRATE CONSUMPTION			
(000's in Short Tons)			
<u>Year</u>	<u>Prairies</u>	<u>Sask.</u>	<u>% in Sask.</u>
1973/74	189.0	21.0	11.2
1974/75	207.7	28.9	13.9
1975/76	236.4	40.0	17.0
1976/77	231.9	48.7	21.1
1977/78	228.1	55.9	24.6

Ammonium sulphate use in the Prairie Provinces has been relatively static during the past five years (Table 12). Saskatchewan has been accounting for between nine and sixteen percent of total ammonium sulphate consumption.

Table 12: Consumption of Ammonium Sulphate in the Prairie Region and Saskatchewan, 1974-1978.

AMMONIUM SULPHATE CONSUMPTION			
(000's in Short Tons)			
<u>Year</u>	<u>Prairies</u>	<u>Sask.</u>	<u>% in Sask.</u>
1973/74	48.0	6.0	12.4
1974/75	54.5	4.9	9.0
1975/76	34.4	3.4	10.0
1976/77	44.5	5.8	13.1
1977/78	48.2	7.5	15.6

Nitrogen solutions should not be overlooked in this review because they are currently a very dynamic part of the western Canadian fertilizer industry. The values

reported for urea-ammonium nitrate solutions (URAN) in Table 13 only partially reflect actual consumption in the Prairies. The principal producer of 28-0-0 solution, has for good reason, chosen to report shipments and sales of this product in terms of its urea and ammonium nitrate components.

Table 13: Consumption of Nitrogen Solutions in the Prairie Region and Saskatchewan, 1974-1978

NITROGEN SOLUTIONS				
<u>(000's in Short Tons)</u>				
<u>Year</u>	<u>URAN</u>		<u>AQUA</u>	
	<u>Prairies</u>	<u>Sask.</u>	<u>Prairies</u>	<u>Sask.</u>
1973/74	42.6	0.7	-	-
1974/75	20.2(?)	0.2	-	-
1975/76	6.0(?)	0.1	-	-
1976/77	29.8	0.2(?)	?	-
1977/78	65.5	2.3	19.1	16.0

Production and use of aqua ammonia are relatively new developments, and most of the activity with it is confined to Saskatchewan (Table 13).

Consumption of ammonium phosphates (11-48-0, 11-55-0, 16-20-0, 18-46-0, etc.) and the various ammonium nitrate-phosphates and urea-phosphates is shown in Table 14. Use of the ammonium phosphates in the Prairies reached about 625,000 tons/year by the end of the five-year period, and Saskatchewan consumed 226,000 tons or about 36 percent of this total. There appeared to be a levelling off or even a decrease in consumption of the nitrogen phosphates.

Table 14: Consumption of Phosphatic Fertilizers in the Prairie Region and Saskatchewan, 1974-1978

PHOSPHATE FERTILIZER USE				
<u>(000's in Short Tons)</u>				
<u>Year</u>	<u>AMMONIUM PHOSPHATES</u>		<u>NITROGEN PHOSPHATES</u>	
	<u>Prairies</u>	<u>Sask.</u>	<u>Prairies</u>	<u>Sask.</u>
1973/74	508.1	160.4	238.5	79.0
1974/75	563.6	191.9	246.5	77.6
1975/76	450.2	148.6	228.3	71.1
1976/77	477.6	148.1	191.3	50.9
1977/78	625.9	226.0	210.7	75.4

The N/P₂O₅ product mix has changed significantly since 1938 when the ratio of these two nutrients was overwhelmingly in favour of P (Table 15). Approximately four times more P₂O₅ than N was still being applied to Prairie soils in 1948. It wasn't until 1970 that the ratio of these two nutrients was nearly one for the Prairie Provinces as a whole. By 1970, the N/P₂O₅ ratio in fertilizers used in Saskatchewan had narrowed to the point where about twice as much P₂O₅ as N was being applied to soils of this province. At the close of the 1978 fertilizer year, the ratio of N to P₂O₅ indicated that N rates were generally about 48 percent higher than P₂O₅ dressings on soils of the Prairies. Meanwhile in Saskatchewan the ratio was still slightly in favour of P₂O₅, but the gap had certainly narrowed with equality between N and P₂O₅ anticipated in the near future.

Table 15: Ratio of Nitrogen to Phosphorus in Fertilizers Used in the Prairie Region and Saskatchewan for Selected Years Between 1938 and 1978.

NITROGEN/PHOSPHORUS RATIO		
<u>Year</u>	<u>Prairies</u>	<u>Saskatchewan</u>
1938	0.24:1	0.22:1
1948	0.26:1	0.24:1
1968	0.82:1	0.46:1
1970	1.04:1	0.49:1
1974	1.03:1	0.52:1
1977	1.45:1	0.80:1
1978	1.48:1	0.91:1

It can be seen in Table 16 that there have been rather remarkable growth rates in plant nutrient use in western Canada during the period 1961-1976, especially when one recalls the dramatic drops in consumption in years such as 1970 and 1971. Considerably lower growth rates have been forecast for the period 1977-1990, but the industry's performance in the two initial years suggests that these estimates may be quite conservative.

Table 16: Rate of Increase in Plant Nutrient Use in Western Canada, 1961-1976 and 1977-1990

GROWTH RATE OF PLANT NUTRIENT USE IN WESTERN CANADA		
<u>(percent compounded annually)</u>		
<u>Nutrient</u>	<u>Actual 1961-1976</u>	<u>Estimated 1977-1990</u>
N	18.0	3.6
P ₂ O ₅	11.2	3.5
K ₂ O	19.0	8.2
Total	15.0	3.7

The relative position of the fertilizer price index to other farm input indexes is examined in Table 17. During the years 1974-78 the fertilizer price index was, with the exception of seed and feed, lower than the other inputs being considered. The fertilizer price index was also substantially less than the average for all farm inputs, therefore, fertilizers have not contributed unduly to escalating farming costs.

Table 17: Comparison of Selected Farm Input Price Indexes, Third Quarter 1974 to 1978

FARM INPUT PRICE INDEXES -THIRD QUARTER- (1971=100)	
<u>Input</u>	<u>Average Annual Percentage Gain 1974/78</u>
Buildings	8.5
Machinery	9.8
Trucks	8.5
Petroleum	10.0
Seed	2.6
Fertilizer	4.3
Pesticides	8.0
Feed	2.3
Labor	10.6
Interest	6.7
All Inputs	6.9