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# FLAX PRODUCTION IN ARGENTINA

*by*

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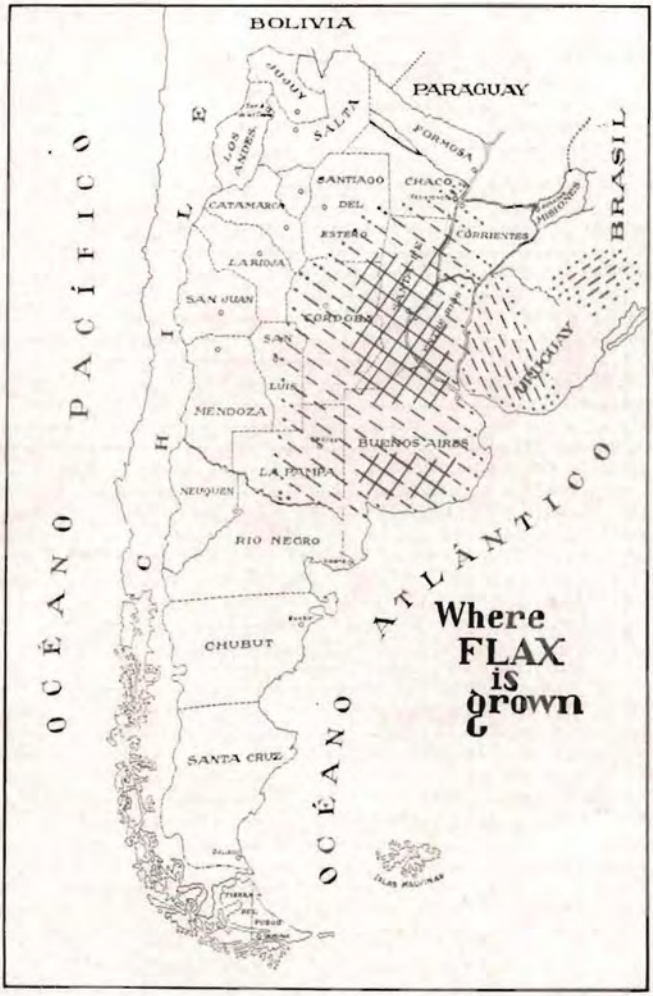


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# Table of Contents

# Flax Production in Argentina

By
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ARGENTINA is the greatest flaxseed (linseed) producing country in the world. Flax being one of the important crops in North Dakota it is of interest and importance for North Dakota farmers to know something about the conditions under which the Argentine flax crop is produced. Our farming population and other citizens are

Stacks similar to these are found thruout the flax district. Grain so stacked is nearly as safe as if it were stored in the local warerooms.

not apt to weigh carefully the very great competition that so distant a country may be able to develop.

The average farm within the United States is of small area. In the past such small holdings have been made to support and educate comparatively large families. In the immediate past our farmers, as compared to those of other nations, have had farm implements and machinery essentially suited to such farms. Only lately have these small American farms come into direct competition with larger areas of land in other countries worked by efficient farm machinery upon mass bases. Apparently, we have not fared as well in the contest as might be wished. The future is not reassuring unless we can readjust methods of competition within and without the nation. *Competition with mass farming under high-grade machinery and efficient, but cheap living labor, apparently lies in the immediate future.*

Our people, particularly the farming public, are naturally optimistic and enthusiastic. They seem to think that in the United States there are such wonderful lands and climatic factors that they may depend upon a broadly educated farming population and high business initiative to carry thru, so as to compete in small grain farming—wheat, corn, flax, etc.—if need be, even in foreign markets. Farming, however, in all countries is being rapidly specialized and, in whatever crop, success follows only after careful business foresight. It is, therefore, of extreme importance that careful attention be given to the conditions of flax farming and marketing of the crop in other countries and particularly to the possibilities of further expansion and development of flax crop production in Argentina.

Just now agricultural economists in all countries are giving much

attention to costs of production, tariff adjustments, etc. But farming cannot be properly compared and adjusted upon such cost accountings alone. Due to certain natural advantages and disadvantages, it is possible that it may matter very little what the comparative costs of production per hectare, acre, or ton, may be in that country and in the United States.

The edge of an extensive flax field in southern Buenos Aires province, near Tres Arroyos. Notice the height as compared to the Panama hat.

Argentina, aside from our own production, is a very natural source for additional linseed which we may need even tho Russia or other countries may possibly be able under certain circumstances to produce it more cheaply than Argentina.

A combined excess of flaxseed in the countries named is thus a factor of fundamental importance in fixing the possible farm market value of flaxseed in the United States; for with us other factors than price alone govern the question whether a crop will be continued or discontinued.

## Argentina

Argentina is over 6000 miles distant, but traffic between her ports and ours is by way of ocean going vessels. Ocean transportation costs about one-tenth as much per mile as rail transportation. North Dakota being 1500 miles from the seaboard is the equivalent of 15,000 sea miles from our seaboard, or more than twice as far as Argentina. The chief agricultural lands lie so near the main deep water ports that regardless of how much more widely the areas of flax production may be expanded, railroad transportation in Argentina must always be a minor factor as compared to that between farmers, crushing plants, and manufactories in the United States. The chief centers of flaxseed production there are so closely associated and so near to various ports that a considerable part of the seed as harvested is actually loaded direct from farm wagons or motor-trucks or at best by efficient loading machinery thru the warerooms at port, after but a short haul, whether by rail or wagons. In any case, if all the seed had to be transported from the farms or local stations by the railroads, the total freight miles would be very small as compared to those involved in the United States, and the production in individual localities is always sufficiently great to admit of efficient hand-

ling of the freight in mass. *Flaxseed production in Argentina is advantageously located as to railroad and ocean freighting.*

Practically all of the cultivated grasses used in the United States are grown extensively in Argentina. Sudan grass areas are commonly associated with alfalfa, for pasture purposes, particularly in the north and eastern zones. This picture represents canary grass, alpiste, grown extensively, primarily for seed purposes and furnishes many thousand tons of birdseed for export.

**Areas of Flax Production:** Production of flaxseed in Argentina is located chiefly within three great maritime provinces, Buenos Aires, Santa Fé, and Entre Rios. It has for some years been showing evidences of rapid expansion into outlying marginal lands and other provinces. These so-called "central" eastern provinces of Argentina are rated as within the temperate zone. They certainly meet all the

Flax in windrow as cut by header, near Pergamino.

requirements of the term "temperate," nevertheless with variations in soil and general climatic conditions. So far as temperature is concerned, the entire region can certainly be specified as moderately tem-

perate as shown by most yearly records. Even in the northern, more nearly sub-tropical sections, heat does not become as intense as in our Northwestern dry land plains, the atmosphere there being tempered by more humid conditions. Even in the southeastern portions of the province of Buenos Aires, in coldest weather, there is not sufficient frost to injure reasonably hardy plants. This tempering of the climatic influences is undoubtedly due to the regulating influence of the Atlantic Ocean and the great estuary of the Parana and Uruguay Rivers.

**The Soil**: The lands or soil of these provinces constitute a great flat plain lying on the east essentially level with the ocean and with the great expanse of the Parana and Uruguay Rivers and their border swamp lands. The lands rise gradually to the westward to what may be spoken of as higher, dryer plains, about in line with the cities of

*Negative by Dr. C. A. Bahre, Buenos Aires*

Northern Santa Fé. Notice quality of soil being turned.

Cordoba and Bahia Blanca. This great low-lying plain, a type of delta formation, is the result of the filling up of extensive swamp lands by silt and organic filled deposits carried from tropic and semi-tropic regions at the north. Even yet, great masses of floating vegetation and animal life are carried down these rivers and deposited in the border swamps or marginal overflowed areas as during past centuries. The soil is of rather even subtexture such as would be characteristic of such river filled lands, giving over these extensive areas plow lands almost uninterrupted by either streams, rocks or trees. There is here a type of soil probably unequalled elsewhere for the production of small grains and forage crops, either as to fertility or climate. Nowhere else have I ever seen so luxuriant growths of corn, alfalfa, Sudan grass and other forage over equally extensive areas.

These particular provinces have certain political boundaries, but otherwise constitute a continuous stretch of land subject thruout to the possibility of the use of extensive machinery types, whether of implements, of tillage, or of harvesting. These provinces form the heart of the present Argentine cattle industry and cereal production, shading gradually off into other natural agricultural areas of great promise, represented by the provinces Rio Negro, La Pampa, San Luis,

Cordoba, Santiago del Estero, Chaco, Corrientes and Misiones. So far as the quality of the soil is concerned, the immediate border lands of each of these and practically all of Cordoba excepting certain central

Thruout Central Argentina, whether in Entre Rios or in the southwestern Pampas, a characteristic landmark is the windmill. In the past herds of cattle sometimes died of thirst. Now they sleep lazily at noontime about extensive shallow ponds or cement constructed tanks to which is furnished a consant water supply by windmill, whether the herdsmen or a farm home is in sight or not.

mountainous portions might well be included with those previously mentioned as one great body of agricultural lands which when properly handled need fear essentially no major crop failures. Thruout these border provinces, there is much wider range of soil and climatic conditions under which the selection of the soil for particular crops must be more carefully made. Such areas will of necessity demand greater care in cropping because in parts of these provinces there are possibilities of periods of extended drought and of crop destruction by frost, insects, and other crop destroying factors more to be feared than in the three provinces mentioned.

Thornless cactus at Bahia Blanca. This and other types of cactus, cultivated and wild, are found thruout the flax growing regions from the southwestern Pampas to extensive native growths in North Santa Fé and the Chaco.

**Climate:** The country as a whole lies in the southern part of South America, approximately within 21° and 55° south latitude and between 52° and 74° west longitude.

Because of the great length from north to south, approximating closely the distance between Hudson Bay and the Gulf of Mexico and because of the great variations in altitudes from the eastern plains to the Andes there is afforded to Argentina almost all possible climatic conditions.

**Temperature:** The range of temperature possible on the east coast from north to south may be somewhat better understood when it is noted that the oceanic influence is such as to greatly temper the coastal regions of the territories in Patagonia.

The following table on average temperatures for the colonial district of the valley of the Chubut, over a 20-year period, shows, indeed, a wide daily variation during the year, yet the absolute minimum is reported at approximately 9 degrees Fahrenheit.* Grain and fruit-growing in Rio-Negro and Chubut, on account of limited rainfall, is, however, done under irrigation.

| | | Average | Average Maximum | Absolute Maximum | Average Minimum | Absolute Minimum |
|---|---|---|---|---|---|---|
| Average | Centigrade | 13.4 | 21.1 | 42.2 | 4.6 | —12.5 |
| Annual | Approximate Fahrenheit | 56 | 70 | 108 | 40 | 9 |

The following table ** should give a fair conception of the mild yearly temperature, at or near the points named.

MEAN NORMAL TEMPERATURES, 1901 TO 1920

| | Centigrade | (Approximate Fahrenheit) |
|---|---|---|
| Province of Buenos Aires | | |
| Bahia Blanca | 15.6° | 60.1° |
| Mar del Plata | 13.5° | 56.3° |
| Tres Arroyos | 14.3° | 57.7° |
| Junin | 16.4° | 61.5° |
| Province of Santa Fé | | |
| Santa Fe | 18.2° | 64.8° |
| Rosario | 17.3° | 63.1° |
| San Cristobal | 19.1° | 66.4° |
| Province of Cordoba | | |
| Cordoba | 16.9° | 62.4° |
| Rio Cuarto | 16.0° | 60.8° |
| Province of Entre Rios | | |
| Concordia | 18.7° | 65.7° |
| Gualeguay | 17.7° | 63.9° |
| Territory of La Pampa | | |
| Victorica | 15.6° | 60.1° |
| Utracan | 15.2° | 59.4° |

The temparture and humidity relations for the Pergamino district are very splendidly portrayed by a table constructed by Dr. Lorenzo R. Parodi giving averages for each month in the year for maximum, minimum, absolute maximum and absolute minimum. The temperatures as given by Dr. Parodi are in Centigrade—those given in the following table are only approximate Fahrenheit temperatures. These

* From "La Colonia del Valle del Chubut, Circular No. 691, May 1927—Ministerio de Agricultura."

** From "Annuario de Estadistica, 1925-26, Section B. P.87, Ministerio de Agricultura."

suffice, however, to clearly demonstrate that at Pergamino actual killing frosts are seldom reached and occur only on a few dates in the mid-winter months of May, June, and July.

TABLE OF TEMPERATURES AND RELATIVE HUMIDITY, DISTRICT OF PERGAMINO, 1914-1928*

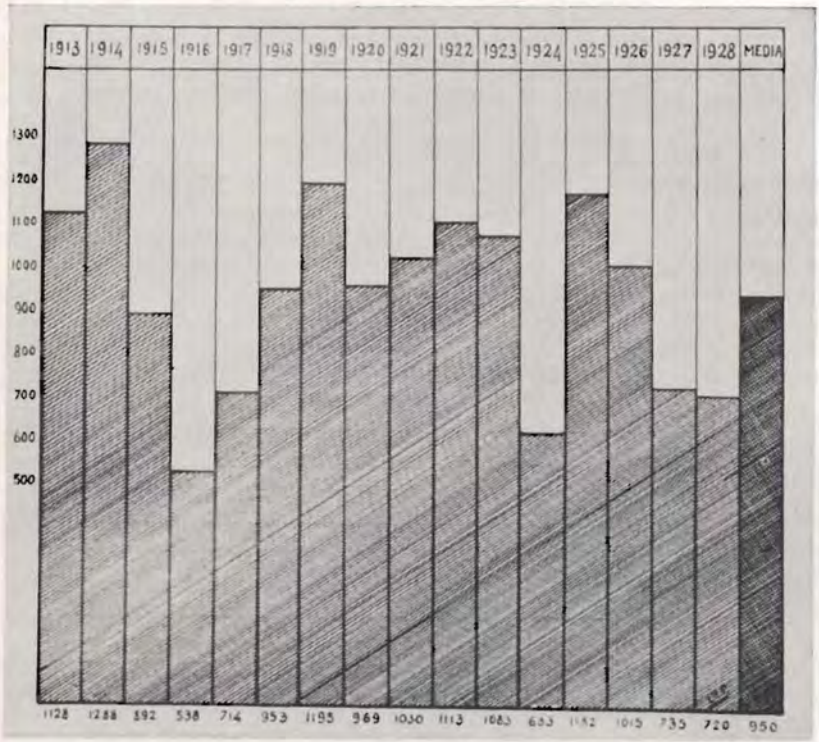
| | Jan. | Feb. | Mar. | Apr. | May | June | July | Aug. | Sept. | Oct. | Nov. | Dec. | Annual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Maximum Temperatures** | | | | | | | | | | | | | |
| Absolute Maximum | 111.5 | 105.5 | 100 | 99 | 88.4 | 82.7 | 87.5 | 93.5 | 94.1 | 95.1 | 100.5 | 107.5 | 111.5 |
| Average Absolute Maximum | 103 | 99.1 | 96 | 90 | 81 | 72.5 | 76 | 80 | 85 | 88 | 94.5 | 99 | |
| Average Maximum | 84.5 | 83.1 | 78.5 | 75.1 | 67.5 | 60 | 60 | 64.5 | 69 | 74 | 81.5 | 86 | 75 |
| **Minimum Temperatures** | | | | | | | | | | | | | |
| Absolute Minimum | 44.1 | 41 | 40 | 28 | 24 | 20.5 | 20 | 24.5 | 28 | 32 | ..... | 24 | 20 |
| Average Absolute Minimum | 48.5 | 48 | 44.5 | 37.5 | 30.5 | 27 | 27.3 | 29 | 32.5 | 37 | 41.5 | 45.7 | |
| Average Minimum | 61.7 | 61 | 57.1 | 52 | 45.5 | 38.5 | 39.1 | 40.5 | 44.5 | 49.5 | 54.5 | 59.1 | |
| **Average Temperatures** | | | | | | | | | | | | | |
| | 77.5 | 75.5 | 71.5 | 64.2 | 56.5 | 49.5 | 50 | 53 | 58 | 63.5 | 70 | 75 | 64 |
| **Average Relative Humidity** | | | | | | | | | | | | | |
| | 62 | 66 | 69 | 75 | 76 | 77 | 77 | 69 | 67 | 65 | 63 | 63 | 70 |

* Lorenzo H. Parodi, Ensayo Fitogeografico sobre el Partido de Pergamino, P.78

**Rainfall:** Reliable and rather evenly distributed rainfall associated with a moderate humidity and a moderate daily temperature thruout the growth seasons on lands such as those in North Buenos Aires, Santa Fe, and southern portion of Entre Rios constitute associated factors which, no doubt, have made these parts of Argentina into one of the chief cereal, grain and flaxseed exporting regions of the world. Nevertheless, in case of the years 1916-1917 a rainfall of over 20 inches in the Pergamino district was not sufficient to prevent destructive crop loss because the rains did not there come during the essential periods of growth. Similar variations in rainfall also occur at other points in Argentina. Such variations, in part, account for the rather great annual fluctuations in the export grain market.

The town of Pergamino lies about 140 miles northwest of Buenos Aires which is somewhat south of the geographic center of this wonderful area of soil and climatic influences. Because of studies of Dr. Lorenzo R. Parodi upon the grass and pasture lands of the prairies in the northern part of the province of Buenos Aires,* I am able to furnish a graph demonstrating the rainfall for the period of years 1913 to 1928 inclusive, as shown in millimeters. By the column at the right it will be noted that the average annual rainfall for this period approximated 37.4 inches while the lowest rainfall, that of 1916, was approximately 21.2 inches and that of the highest, as shown for 1914, was 50.7 inches.

* Ensayo Fitogeografico sobre el Partido de Pergamino, p. 81




Graphic demonstration of the rainfall for the years 1913-1928 in the district of Pergamino.

**Native and Introduced Plants Index of Soil Quality and Climate:** Hearing of the rigors of the climatic conditions on the Argentine plains bordering the Andes, of droughts and intense heat of the central or median regions, one used to the characteristic short seasonal

Field of orange trees near the city of Concordia in eastern Entre Rios. Notice the wild palms, interspersed with cultivated orange trees. From Concordia, south and westward, there are extensive areas of flax interspersed amid the cattle ranches.

periods of northwestern United States can hardly understand the rather mild uniform climate that prevails in the littoral regions of Argentina. Even as far south as Bahia Blanca, introduced plants

call attention to a mild temperature, even in what Argentine people call winter. One finds beautiful sycamores, robinias, locusts and other warm climate shade and fruit trees in Bahia Blanca, Buenos Aires and intervening cities. In Uruguay and in the plains of Entre Rios and north Santa Fe, one sees extensive pasture lands and even tilled areas in which palm trees, native and introduced, stand out among the cultivated crops. Self-seeded palms are often in sight in eastern Entre Rios. One may not forget that in this and the chief flaxseed growing regions of Santa Fé, and northward into the Chaco, Argentina is growing the major portion of her flaxseed in a very mild climate. Large plantings of cactus may be seen at all points from Bahia Blanca northward thru Cordoba, and immediately northward from Santa Fé, the wild growths and cultivated fields are characteristic of such regions as Arizona and New Mexico.

There, as elsewhere, native growths and introduced plants are particularly good indications of soil and climatic values. Roadside

Large growths of thistles are a good index of strong land. Secretary A. Hojman of the Ministry of Agriculture and Director Boaglio of the Pergamino Experiment Station.

weeds, particularly enormous growths of annual thistles, thruout the black soil regions indicate soils of heavy type and great productive value.

*These observations quite convincingly indicate that it is possible there are regions in the United States where high-quality types of flaxseed might be produced other than the regions which now furnish our chief supply.*

**Long Planting and Harvest Seasons:** Thru the greater part of the maritime provinces, the humidity and temperature is so governed by oceanic influences that they remain thruout the year essentially free from destructive frosts, and a long, so-called winter with springtime-like weather affords in these provinces and portions of the border provinces long possible "planting seasons" for cereals and

small grains. This condition is variable according to location, but the period in which planting can be done is always sufficiently long that farmers are not of necessity compelled to rush their entire crop into the ground in a comparatively short period of time. They, in fact, have actual opportunity to exercise what may be spoken of as early and late

*Negative by Dr. C. A. Bahre, Buenos Aires*

Home of Italian colonist, North Santa Fé.

planting without jeopardizing the crop. If, for example, during the normal planting periods of May and June in the northern portions, Santa Fé, and Entre Rios. the soil chances to be dry, there is a longer period at which it is safe for the farmer to wait and continue the preparation of the soil for later planting and yet be reasonably certain that the crop will come along all right after the rains do come. From an agricultural standpoint, this is a feature of very great importance, not possible on the Great Plains under our North American conditions. Whether southward or northward with us, intensely hot weather usually follows the time when planting should ordinarily occur. Thus a drought period with us in the springtime may prove very destructive to cereals and such crops as flax because a very rapid growing season at once prevails if one waits for rain to come before planting in the spring.

**Seed Time and Harvesting:** Because of the extended territory from north to south and great variations in climatic and soil conditions due to a varied topography and particularly to the gradual rise in elevation, there is naturally a wide variation in the dates of planting for flax, wheat, corn and other small grains; and approximately an equivalent range of time in harvesting, threshing, storing and marketing of these crops. In the northern portions of Santa Fé, Entre Rios, and further north, plantings begin in early May, but the average date there approximates June 1 to June 15. Beginning at a point in the province Santa Fe on the Parana River near the city of Santa Fe and running southward to a point approximating the city of Buenos Aires, early planting appears to be from July 15 to July 25 while later plantings range from July 25 to mid-September.

As the boundaries of certain planting zones approach the interior the planting is earlier than on the coast. These zones of plantings and harvesting bend rapidly to the north as they approach the dry

land and higher altitude of Cordoba. In the western provinces the lines bend rapidly to the south so that in the territory of the greater Pampas westward from Bahia Blanca the average date of planting there runs from July 15 on the southwest line of the province to September 20 on the southeast.

Distant view of a large estate in Entre Rios (estancia).

In the great province of Buenos Aires, south and east of the center, the median planting dates range from September 20 to October 5, and the harvest periods extend over like wide range of dates during the months of November, December, January, and February.

Probably no great cereal region is so condensed as that of the eastern portion of Argentina and yet furnish such wide range of dates for planting and harvesting, yet it must be understood that under such wide variation and topographic conditions, crops such as flax and wheat are at times subject to great loss because of sudden climatic changes. While in most years slight, if any, frost ever occurs in east central Argentina. Nevertheless, there have been years in which great damage was done.

While the production of flax may usually be relied upon to produce approximately 60,000,000 bushels per year for export, drought during the period of planting or rain at harvest have, at times, caused great destruction. For example, excessive rainfall in January, 1931, just preceding harvest thruout the north and central parts of the province of Buenos Aires, prevented the harvest of approximately one-third the entire flax crop and other grains were also greatly damaged.

Quoting dates of sowing and harvesting of grain for the province of Buenos Aires from the "Almanaque de Ministerio de Agricultura" for 1931, one finds the following statements:

January (Mid-summer): Termination of harvest of wheat begun the previous month. Beginning of harvest of flax. Preparation of lands for winter forage when seeded with oats and barley, etc. and to be seeded with alfalfa in the month of April.

February: Continuation of labors of the previous month. Terminate the threshing of flax, wheat, barley, oats. Begin seeding of oats.

March: Continue plowing and harrowing in preparation of the land for winter wheat. Begin seeding of alfalfa, ray-grass, barley, and continue with the seeding of oats for forage.

April: (Autumn): Begin harvest of early maize (corn) and continue the seeding of alfalfa, ray-grass and other grasses. Pasture the oats seeded in February. Continue preparation of the soil for seeding of wheat, flax, canary grass and barley. Continue the seeding of oats for winter pasturage.

May: Continue and terminate the picking and storing of maize. Ter-

mination of seeding of alfalfa. Begin seeding of winter varieties of wheat—Russian, Kanred, etc. Begin seeding of oats for grain production.

June: Continue seeding of wheat, flax, oats, barley, rape, etc.

July (Mid-winter): Terminate the winter seeding of wheat and flax. Continue preparation of the soil for seeding corn and alfalfa.

August: Continue seeding early varieties of wheat, as for example, Marquis, the various flaxes and canary grass. Continue plowing intended for seeding of corn. Pack wheat lands showing tendency to dry out.

September: The planting of maize (corn) should be begun.

October (Spring): Plant red corn, wheat and sweet potatoes, also alfalfa.

November: Plow for maize (corn) and prepare to plant early varieties.

December: Begin cutting wheat and alfalfa. Continue the cultivation of maize.

The fact that in most parts of this province such crops as corn, oats and barley may be planted, cultivated or harvested in absence of frost during several months of the year indicates the wide periods of time available for preparation of soil and seeding of the small grains and flax. Other provinces to the north allow of even greater variation in dates of planting and harvesting, yet there are, of course, certain average or median dates which give the greatest assurance of returns, and as elsewhere are generally followed. Thus flaxseed harvest in Argentina usually starts early in November in the northern zones and threshing is usually finished in the southern zones in February.

The possible planting period in those Argentine plains thus widely extended also extends the harvesting period for such crops over a longer period of time. It is not at all uncommon to see on one area of ground a crop of maize or corn matured and picked or harvested


Modern Deering tractor and Case combine dropping off a consignment of bags. Two men stand on platforms; one does the sewing.

while immediate adjacent fields of large area are only in the early growth period or approaching tassel or ear formation, preparatory to a harvest to follow some months later. While with exception of the extreme north, it would not probably be possible for any farmer to have two crops of any one of the small grain crops upon the same

area of land, many farmers in actual fact are able to produce two or more crops of corn upon the same farm, and it is not at all uncommon to find flax which has been harvested and in the stack or in local warerooms for two or more months while other flax on the same farm is yet approaching maturity. *This wide range of possible planting and harvesting periods available to use in the same farm zone, in part, accounts for the fact that comparatively few laborers are able to plant, harvest and handle the crop on much larger areas than the same number of men could do upon the Great Plains in the United States.*

**The Growth Seasons are Usually Favorable:** A factor of quite as great importance as that afforded by the long-time planting and harvest seasons results from the fact that a long, slow growing spring season in which moderately cold temperatures prevail really admits of a more complete rooting and development of cereal and small grain crops, particularly of flax, preparatory to the period of flowering and seed setting. A moderately humid atmosphere extending over the blossoming period is particularly favorable to the flax crop. This is well understood by plant pathologists familiar with the destructive effects of root diseases as influenced by seasonal temperatures, soil and atmospheric moisture. It is well-known that the wilt diseases of flax become much more destructive when soil and atmospheric temperatures become unfavorable to the normal growth of the flax plants. With us, under conditions in which the top layers of the soil bakes, cracks or rapidly dries out, most varieties of flax are brought rapidly to an early ripening or death condition. In the case of flax-wilt infected soil, the roots and stems die rapidly, the water supply from below being cut off.

High-class field of flax in eastern Santa Fé, selection strain No. 9-D of Dr. Boerger, of Uruguay.

In the leading flax zones of Argentina, while it is our usual conception that they have extremely hot weather, during the growth season I found that the temperatures of 95 to 102 were not nearly so destructive upon growing flax there as with us in our semi-dryland areas in Western Minnesota, North Dakota, South Dakota, and Mon-

tana. It is easily understood that with a humid atmosphere and soil not readily dried out, the crop should go on to a more fruitful finish. Argentine varities of flax which, with us, ordinarily develop but short straw and much wilt usually produced much longer, sturdier straw in the regular flax zones of north and central Santa Fé. This is due no doubt to the fine, even texture of the soil and even reliable moisture content of the sub-soil, which condition appears to be much less favorable to the spread of wilt infection than with us.

**Farm Work on a Large Scale:** Farming in Argentina is done on a comparatively large scale. In the early provincial days following the introduction of cattle, there was an extended period in which ranching and herding of comparatively wild cattle was the chief source, not only of the nation's food supply but of commerce. The land in a large way was preempted or entered upon by the leading families following the various wars and revolutions and was finally held in great areas somewhat similar to conditions in early feudal Europe. Thus sprang up the great estates (estancias), many of which

Near view of the home on a large estate (estancia) eastern Santa Fé. Intensive farming is the rule in this district.

are still in existence under an extensive land holding system. These lands are under the supervision of able managers, sub-managers, and tenants, and cereal and small grain crops are produced and handled upon a scale far in excess of what is usually understood by our people. Here in the states, we have been in the habit of speaking of "bonanza" farms, meaning farms of enormous acreage, but even the largest of these, such as the Elk Valley, Dalrymple, or Amenia-Sharon farms, were comparatively small holdings. Indeed, it is said that fully one-third of the land of the province of Buenos Aires is yet under the management or control of 11 families or farm managers.

Even the average area of farms under private ownership represent far greater acreages than in the case of ordinary farms in the United States. Intermediate between the colonial and smaller (native Crillos) holdings stand these so-called "small farms," many of which are

splendidly managed and operated and vary in area from approximately 5 or 6 thousand to 12 thousand acres.

In various provinces of the country are located colony holdings, representing practically every European nation. For example, there are several large colonies of Jewish farmers in eastern central Entre Rios, and a large district long settled by Russians in southwest Entre Rios, around Victoria, Other zones in the province of Santa Fé are occupied by Swiss and North Italian groups and smaller colonial groups in the province of La Pampa and other southern, western, and central provinces. Naturally the Russian colonists turn to the production of wheat, flax, and cereals, characteristic of their home training while the Swiss colonists, as for example around Esperanza, Rafaela, and extended territories immediately west of Santa Fé work upon land holdings varying from 200 hectares (approx. 500 acres) to several thousand acres. The Swiss give their attention very largely to dairy

Heavy flax crop in Pergamino district, stacked and bunched flax in foreground. Alfalfa and corn in the distance.

farming. About the work of these efficient colonists are centered some very wonderful butter, cheese and casein industries. The North Italian colonists often occupy large holdings and give their attention more extensively to corn and small grain farming. These Lombards have been coming in at a later period and are naturally found in the newer districts, but are far more efficient farmers than the railway laborers and city-loving, vegetable-gardening southern Italians with whom we are more familiar.

**Specialized Farming:** An interesting feature of Argentine agriculture rests in the fact that their chief farmers and agriculturists have specialized by crop and have apparently paid quite close attention to the fact that certain zones afford rather definite returns for the crops upon which they place most attention. For this reason there are yet large areas of territory which appear to be lands well suited to further extension of wheat, flax, and other small grain production. The main crop efforts have been, as yet, chiefly confined to important or primary zones of high production for wheat, corn, flax, potatoes, alfalfa, etc. These zones of special crop production, as of wheat, flax, oats, barley, corn, alfalfa, quite naturally now overlap. It is possible, as the country becomes more generally broken into farms handled by methods characteristic of Northern Europe and North American farming, there will be found other areas which are particularly suited for the cereals and small grain crops, particularly when associated with cattle farming and more intensified agriculture.

While it is a fact that flax grown for linseed production may be successfully produced in essentially any region in the world in which one can produce a good crop of wheat, it is interesting that the chief regions of flax production in the Argentine provinces yet correspond closely to those zones which are given over to the cropping of maize,

Great corn fields shade imperceptibly into great alfalfa fields. Notice the new type of metal corn crib in the distance.

alfalfa, cattle and pasture lands. As yet, flax farming has not largely moved into the primary spring wheat areas. *The areas used for flaxseed production are those of highest quality soil in Argentina.* Heavy yields of winter wheats are also grown in these same zones of highest flaxseed production; but the wheat crop is more extensively produced over a much larger territory, particularly in the provinces of La Pampa, San Luis, Cordoba, and south Buenos Aires.

**Rotation:** As indicated in the discussion on specialized farming, if one asks the question in Argentina, "What rotation has been followed on a special area of land?", regardless of whom one asks, he is most apt to get the answer, " 'There is no particular rotation.' 'Argentine farmers are specialists.' 'Our flax planters specialize in flax.' " The men growing corn in the corn belt are corn producers. Many of them are renters, others are farming under contract or on shares. In any case, it is not at all uncommon for one farmer to have under cultivation 200 or more hectares (approximately 500 acres). The renter or contracting farmer naturally aims to procure the richest, heaviest, and most productive soil for which he can arrange. Under the contract or rental method, he may farm the same land to corn for a number of consecutive years. Often the owner of the land can

High class herd of some thousands in eastern Entre Rios.

furnish him another area similar to the one under crop each succeeding year for a number of years. On the large estates (estancias) the manager may thus so contract the land under his control to a number

of such 'expert' corn growers in such manner that the individual lots or areas are so placed as to essentially constitute one extensive corn area. This works out advantageously to the large land owning farmers and also to the corn producers. They are able to move to new areas any year agreeable to both parties and the manager has at his command a large area for pasturing off and for the following cereal, flax, alfalfa, or other crop. This system or plan of tenure thus affords a *crop rotation* of highest quality made to order if, indeed, not actually thought out and insisted upon by the owner or manager.

In certain zones or regions, especially in marginal lands with lesser certainty of water supply, corn and alfalfa are often planted together, and after the corn is properly matured and picked, the cattle are turned in to eat the roughage of the corn and to begin feeding upon the alfalfa, which at this time is usually knee high to the cattle. Under these processes of farming, especially on the large estates, in many of the farming zones the fertility and productivity of the soil is of such type that it is not uncommon to plant corn two or three times, or even more years, in succession. However, this is apparently a matter of adjustment of the renters or corn specialists with the management of the estate concern, and it is a well known fact that most of these large estates govern their production of the cash crop, such as corn, flax, wheat, largely in accord with the necessity of providing roughage and sufficient pasturage—forage—for the large herds of cattle which are with these estates of first importance in farm economics. Apparently the large areas of alfalfa which are held in

This herd was photographed on the Naon ranch approximately 30 miles west of Pehuajo, about 220 miles west of Buenos Aires. These cattle are in an over-pastured alfalfa field. On this ranch I saw in one field 55 pedigreed roan Shorthorn bulls. The owner manages 30,000 hectares in which crops are all handled for the purpose of furnishing feed for the stock. There was, for example, in one field 2000 hectares of corn and alfalfa grown together, preparatory to pasturing.

pasturage are plowed up only when conditions no longer properly afford efficient pasturage. According to statements made to me by those best informed these large alfalfa fields may at times, according to weather conditions and to amount of pasturage, remain in the alfalfa from 3 to 7 or more years.

Thus, when these pasture lands are again broken, the alfalfa sod, weeds and native grasses which have come into the long-pastured areas form a splendid basis for cereal crops and a perfectly natural place for the growth of the flax crop which is perhaps more commonly planted in these alfalfa lands than on either native sod, corn or other cereal producing areas. With us, perhaps no question is more often asked than that which involves the cost of small grain, corn, or flax production. This is likewise the most difficult question to determine. Even the price of land and rental values as given in the transfer records can only be understood by one thoroly familiar with the zones of production, the prevailing cash and crop contract rentals and the real estates values. All these are again subject to the fluctuating value of the pesos and intensely varying local costs of living. The major rural industry is cattle production. On all large areas this factor not only governs rental terms but farm plans. This also is reasonably true on the smaller farms.

# Flax in Relation to Major Crops

**No small grain crop so well prepares the soil for future flax cropping as maize.** Even tho flax is quite normally placed directly upon grass and alfalfa pasture lands, the deep plowing and the cultivation given to corn there as here prepares a proper subsoil texture for the deep rooting habits of the flax crop.

Great areas of corn dot the landscape surrounding the cities of Buenos Aires, Rosario and Santa Fé, and are also found in south and western Entre Rios.

**Corn Production in Argentina:** While on various observation trips, I was astonished by the extensive areas in which corn (maize) is grown. One sees there larger continuous fields in corn than one may locate anywhere even in Illinois, Missouri, or Iowa. The reason for this is based largely upon their method of farm specialization. With corn, as in other crops, there are often, indeed usually, extensive areas of land under the management of individual farmers, managers, and renters or land owners.

The method of cultivation and harvesting corn is quite unlike any corn cultivation and methods pursued in the United States. The varieties are fine, hard, flinty types, particularly resistant to weathering after maturity. The crop is grown primarily as a cash crop with the purpose of selling the shelled grain for export and for local distillation.

As yet, corn production in Argentina has not been largely developed primarily for the purpose of forage and feed. The silo is not as yet in extensive use and insofar as the crop is used for forage purposes, it is yet commonly one of pasturing off by stock, chiefly by beef or dairy cattle, after the ears have been picked. Generally, the corn is not check-rowed as in the United States but is commonly thickly planted in continuous rows set approximately 26 to 28 inches

In May and June the local warerooms in the corn districts are more than full of shelled corn. Notice the common mode of grading the grain for export.

apart. The corn is dropped so as to produce two, three, or four stalks per hill in the row about 14 to 16 inches apart. Plantings seem usually to follow upon old pasture lands or upon previous corn lands and after rather careful plowing or soil preparation. In the regular corn zones the superior qualities of soil and rainfall are usually sufficient to support this heavy and more or less continuous planting. One is astonished at the rapidity of growth and the rather small amount of tillage necessary to keep down the weeds under such methods.

Very soon after the corn reaches the height of two or more feet the ground is densely shaded and further tillage can hardly be carried out. Usually the corn is "laid aside" and cultivation discontinued by a deep listing or breaking up of the center by a single, wide flaring shovel so as to slightly hill up the corn and leave a central drainage line, a process not desirable with us and I am doubtful if it has any merits with them because of excessive root pruning which occurs. However, one not familiar with annual conditions of lands and with the purposes of cropping may easily draw wrong conclusions in such

matters. In the fertile productive areas of the principal corn zones, it is apparent that surface drainage may be well served by this method of "laying by", furthermore, the growth is often very heavy and the ridges may in part act as insurance against lodging during times of heavy winds and rainfall.

The period for corn planting in the present chief corn zone ranges over rather extended limits, corn planted in early May being thoroly matured in late October or early November. Corn, however, is also so planted that ripening and picking in the chief corn zones continue

Local warercom and freight car being loaded. Such cars are covered with canvas before being moved in transit.

during the months of January, February, March and April—indeed, it is an Argentine saying that Argentina plants and harvests corn each month of the year. The area of most intense corn production may be roughly described as lying within a semi-circle thru the cities of Buenos Aires and Santa Fé, with the diameter on line of the Parana River. A second zone of much greater area and of apparently high class climate and soil for corn production lies immediately to the north, south and west, the continuity of the corn fields in these marginal areas being more generally broken by large expanses of alfalfa, cereals, and pasture. This belt of less intense corn production includes the north two-thirds of the province of Buenos Aires, east half of the province of Cordoba, and all of the province of Entre Rios. A third semi-circle of irregular outline, running thru the cities of Bahia Blanca, Cordoba and striking the Parana River at a point approximating the center of the west boundary of Corrientes, includes the chief areas of more scattered or less intensive corn plantings. Within each of these outer areas, the corn seems at present to be grown chiefly with the purpose of furnishing feed and forage for stock after the corn is picked. Often, it is planted as a sort of nurse crop to extensive areas of alfalfa. The outer belt includes many areas of semi-dry land type and there are, undoubtedly, years when the corn produced does not furnish heavy yields of ears. Nevertheless, it is apparent

that the areas of corn planted are as widely distributed in the different provinces of Argentina as wheat. Statistical data show that the acreage planted is approximately median between wheat and flax. Similar data show maize to be a major Argentine cash crop for export.

*Negative by Dr. C. A. Bahre, Buenos Aires*

Colonist's home, improvised corn-crib, large flax field in the distance—north Santa Fé.

Passing into the marginal lands from the heavy soils, the areas of successful corn and flax production are naturally located in smaller, scattered zones of best land quality. Corn being a warm climate crop largely accounts for the fact that the outside lighter soil provinces to the north and northwest show considerably larger acreages of corn than of wheat. (See table of comparative acreages under column headed 'Other Provinces'.)

*Negative by Dr. C. A. Bahre, Buenos Aires*

In north central Entre Rios, northern Santa Fé and Chaco, there are great areas of native pasture lands, yet untouched by the plow.

As the varieties of flaxseed which are at present grown, are particularly warm region types, the crop apparently thrives splendidly

to and north and east of the present zones of greatest production. It is, therefore, quite certain that large areas of successful corn production, alfalfa production and pasture production in these northern provinces will eventually be found capable of heavy flaxseed production, and as there was planted during the past decade somewhat over one half as many acres of corn as wheat, approximating twice the areas seeded to flax, it is evident *that it is possible for Argentina to largely increase the area of flaxseed production so far as a suitable yield per acre is concerned.*

In this connection compare the areas of corn cultivation in the different provinces to the areas of flax production as given in the table of comparative production by provinces.

The following tables show comparative acres in hectares, as planted to corn and to wheat, by provinces, 1872-1930, inclusive. Compare these areas with those given for flax culture on page 36. (*One hectare equals approximately* 2.47 *acres*).

Maize (Corn)—Hectares Seeded

CORN AND WHEAT PRODUCTION—COMPARATIVE STATISTICS

| Year | Buenos Aires | Santa Fe | Cordoba | Entre Rios | Pampa | Other Provinces | All Argentina |
|---|---|---|---|---|---|---|---|
| 1872 | ..... | 1,665 | 36,580 | ..... | ..... | ..... | 130,430 |
| 1888 | 510,071 | 60,901 | 78,999 | 47,208 | 4,530 | ..... | 801,588 |
| 1895 | 669,112 | 185,898 | 95,217 | 72,721 | 2,765 | ..... | 1,244,184 |
| 1917 | 1,405,470 | 1,250,500 | 570,000 | 84,000 | 29,600 | ..... | 3,629,570 |
| 1924 | 1,443,140 | 786,000 | 609,100 | 111,000 | 116,800 | 359,400 | 3,425,440 |
| 1925 | 1,505,200 | 850,000 | 672,000 | 76,500 | 203,700 | 400,300 | 3,707,700 |
| 1926 | 1,571,000 | 1,100,000 | 818,000 | 129,500 | 238,500 | 440,000 | 4,297,000 |
| 1927 | 1,606,400 | 1,029,500 | 737,700 | 143,000 | 299,000 | 473,400 | 4,289,000 |
| 1928 | 1,640,490 | 1,114,960 | 849,850 | 165,000 | 152,000 | 423,700 | 4,346,000 |
| 1929 | 1,749,320 | 1,273,000 | 960,540 | 172,400 | 189,300 | 443,440 | 4,788,000 |
| 1930 | 1,952,300 | 1,656,125 | 1,168,900 | 222,700 | 194,200 | 453,175 | 5,647,400 |

Trigo (Wheat)—Hectares Seeded

| Year | Buenos Aires | Santa Fe | Cordoba | Entre Rios | Pampa | Other Provinces | All Argentina |
|---|---|---|---|---|---|---|---|
| 1871/72 | ..... | 35,861 | 13,242 | ..... | ..... | ..... | 73,096 |
| 1887/88 | 246,788 | 401,652 | 55,777 | 67,319 | 163 | ..... | 815,438 |
| 1894/95 | 367,446 | 1,030,898 | 293,700 | 292,108 | 370 | ..... | 2,049,683 |
| 1916/17 | 2,305,000 | 800,000 | 1,860,000 | 340,000 | 1,026,000 | ..... | 6,511,000 |
| 1923/24 | 2,433,648 | 1,104,385 | 2,000,000 | 396,000 | 899,310 | 133,500 | 6,966,843 |
| 1924/25 | 2,583,100 | 961,000 | 2,110,200 | 419,600 | 981,400 | 145,200 | 7,200,500 |
| 1925/26 | 2,858,540 | 953,750 | 2,235,100 | 458,200 | 1,118,400 | 145,000 | 7,768,990 |
| 1926/27 | 2,990,000 | 877,000 | 2,172,000 | 410,000 | 1,200,000 | 151,000 | 7,800,000 |
| 1927/28 | 3,131,000 | 888,600 | 2,247,000 | 465,000 | 1,097,000 | 149,400 | 7,978,000 |
| 1928/29 | 3,384,000 | 983,000 | 2,360,000 | 461,200 | 1,148,400 | 171,100 | 8,457,700 |
| 1929/30 | 3,280,070 | 856,000 | 2,224,000 | 415,280 | 977,800 | 132,850 | 7,886,000 |
| 1930/31 | 3,727,600 | 916,500 | 2,443,700 | 412,200 | 918,000 | 208,200 | 8,625,200 |

From Memoria, Bolsa De Commercio Del Rosario, Ano 1930. Pages 240 and 242.

**Wheat:** It is hardly necessary in this bulletin to give special attention to wheat for rather accurate data may be obtained from statistical tables on production and exportation. Wheat cropping has a bearing upon flax culture chiefly because in most countries linseed

production has been usually closely associated with wheat and other cereal grains. In Argentina, methods of wheat production do not differ materially from those on our Great Plains other than that considerably larger areas are worked as a body. Machinery types are

An old time combine, 14 horses, cutting wheat in western region of the province of La Pampa.

essentially the same. Plows, harrows, mowers, reapers, binders, headers and combines are in action on areas of wheat, on even more extended scale than one can usually see anywhere in the United States.

The varieties grown are essentially similar to those grown with us. Large areas of winter wheat and spring varieties are grown. The winter wheat predominates in the corn and northeast zones; the spring varieties on the great expanses of prairie lands, south and westward. As a spring variety, Marquis has been much grown. Of the winter varieties Kanred is becoming rather extensively used. Durum varieties are grown in many of the more dry-land districts.

Wheat usually precedes flax and other types of grain raising on the great plains of the southwest. This picture shows the way the grain bags stand in line after the combine. Director Ingeniero Raimundo Nieves of the Guatrache Experiment Station, Province of La Pampa. There are 20,000 hectares in this area.

Argentine people make much use of pastry products, particularly macaroni. Macaroni, noodles, spaghetti are commonly home-made and constitute a large element in daily production in small local shops in villages, towns, and cities. These products are usually sold in fresh

undried form on approximately the day made. One sees macaroni made and sold in butcher shops, groceries, and other establishments.

Flour milling is developing rather rapidly and considerable export trade is being developed. There as here, increased production in wartime and failure in prices has brought about increased production of other pay crops; and large areas of wheat stubble have naturally gone into flaxseed production. This tendency is particularly true in southeastern spring wheat areas where corn production has not yet become extensive. Here the crop meets with many of the major difficulties of climate and soil characteristic of our great plains.

**Wheat Diseases:** One of the chief drawbacks to wheat production has been extensive infections of wheat rust. Argentine growers have readily controlled the smuts but have not previously paid much attention to the destructive effects by root diseases; thus aside from rust attacks there is heavy destruction of crop by scab and other root and seedling wheat diseases on areas of too constant wheat culture. As with us there are extensive invasions of black stem rust, (*Puccinia graminus*). It is claimed that few, if any, barberry bushes have ever been planted in Argentine farming districts, or in the parks of the villages, rural communities and cities. This is difficult to understand for the early colonists were from Southern Europe and their late emigrants, as with us, are from every barberry loving nation of Europe.

Senor Del Campo—third from right—Director Nieves and a native manager of one of Del Campo's numerous grain farms.

It was not possible for me to give sufficient attention to the matter to confirm this claimed absence of barberry plantings other than that the casual observation open to me tended to confirm statements that the bush is not now commonly planted. Only two or three bushes of *B. vulgaris* were seen by me and these were under study by agronomists who claimed that no infections could be made. Nevertheless this

contention of wheat growers there as once in this country needs more careful confirmation for the virility of attack indicates aecidium spore sources. I am convinced from botanical records that wild species of the barberry family capable of carrying the spring spores of wheat rust will eventually be found in the draws and foothills of the Andes and possibly elsewhere. From the western hill lands and colder regions needed by the barberries it is but a short distance to the great wheat fields of the plains.

The destruction and shrivelling of grain *from black stem rust, leaf rust* (*Puccinia triticina*), and *also from striped rust* (*Puccinia glumarum*), *has been so great at times that these rust factors have also tended to increase the popularity of flaxseed production.*

Enormous herds of native long-horned cattle once roamed the Pampas. Similar herds sometimes with thousands of cattle in them are yet to be seen. They are nearly always largely crossed with beef types, either Hereford, Shorthorn or Polled Angus. A number of thorobred bulls are usually seen in such range herds.

**Cattle**: The Argentine Pampas both in the heavy lands of the north and east and in the so-called "greater Pampas" of the south and west, were for more than one hundred years extended runways for wild cattle, horses, and sheep. These grazed upon heavy growths of native grass over most of the present agricultural territory. The native soils thus became immensely productive previous to the time of the importation of high class clattle, sheep, and goats which characterize the country at the present time.

On the southwestern Pampas and in central Entre Rios, white-faced cattle predominate among range herds.

Cattle raising has always been the paramount industry of Argentina. The managers of great estates and native land holdings early introduced from England and Scotland the finest pure bred types to

head up the herds of the "estancias." As early as the year 1911 the cattle industry was reported in at a value of $700 million in gold. There were listed 29,400,000 cows, 74,000,000 head of sheep, and 4,600,000 goats, and other stock in proportion. In the crop year of 1922, the statistics indicate that Argentina, as a stock producing country, was even at that time second only to the United States, listing 37,064,850 head of beef and dairy cattle, 36,208,981 head of sheep and approximately 10,000,000 head of horses. In the near future, only Soviet Russia is likely in any way to compare with Argentina in the production of cereals and cattle for exportation, and even they for some time are likely to be busily engaged developing their own great home consumption.

**Pasture and Forage:** As soon as the managers of these estates began to introduce pure-bred Shorthorn, Hereford, and other types of

These pedigreed Shorthorn cows are representatives of the red type of Durham found on many of the large ranches.

beef cattle, they made extensive preparations for pasturing and feeding. This brought about extensive plantings of cultivated grasses, lucerne (alfalfa) and other legumes. In 1911 the acreage of alfalfa and cultivated grasses was placed at 5,400,580 hectares, approximately 13,339,432 acres. With this there was listed a corn crop representing 7,941,914 acres, and other types of cultivated legumes, beans, peas, approximately 5,278,390 acres.

In the expansion areas where corn is being planted, it is common practice with the Argentinos, especially on the large estates, to plant large areas of alfalfa, Sudan and other grasses to pasture off along with the roughage of the corn.

Thus with the cattle industry the main factor in agriculture, leaving out of consideration extensive areas of native sod lands long under pasturage and hence ready for the plow, there are very extensive areas of cultivated pasture being prepared upon the finest lands for enormous herds of high grade cattle in fertile zones where each change of crop is looked upon by the managers and by the many colonists and farmers as but cash crops preparatory to the support of the ever-expanding beef cattle, sheep, and dairy industries. These pasture lands are held under pasturage only so long as giving assurance of

proper yield of forage. In the districts of high rainfall and suitable soil drainage and texture this period of pasturage may extend over a number of years, but ultimately they come into tillage for corn,

In the province of Buenos Aires east and central, one sees large herds of high-class Shorthorn steers ranging from 1 to 2½ years old.

flax, wheat and other small grains with assured productivity. *This in a large way explains another great advantage which the Argentine farmers now hold in the production of cereals, small grains, and flax.*

**Alfalfa:** Ever since the first years of Argentine agricultural development, lucerne (alfalfa) has been with them essentially a national crop. Even in the time of their battles for independence, it is said that great fields of alfalfa were developed in the draws and foot-

Argentina's grain and flax production and great cattle industries all depend upon wonderful areas of alfalfa. Such ricks of alfalfa hay dot the landscape, particularly in the dairy and beef cattle district. In north Buenos Aires and eastern Santa Fé, four, five and six cuttings per year is the rule when under hay production. Large herds of beef cattle are often seen knee-deep in green alfalfa in the Argentine winter months. The cattle are literally fattened on alfalfa.

hills of the Andes to furnish hay and forage for the cavalry, cattle, horses, and mules used in the battles for independence and the intensive wars with the Indians. This love for and culture of alfalfa has been continued and the crop shows constant yearly increase. No lands anywhere in the world seem to be better suited to the development of this wonderful crop.

I have found it difficult to get any reasonably definite statistics as to the acreages now actually used for the culture of alfalfa. Practically all those given to me by those competent to judge makes it a safe guess that there are at present approximately 20 million acres of alfalfa growing within the leading agricultural zones and provinces.

This is exactly the home of the flax crop at the present time and the territory into which it may expand approximately as fast as pasture and corn lands are made vacant for the crop. Ultimately all such pasture areas come under the plow. If, therefore, the products of the flax crop on the world market chance to be in such demand as to warrant a pay crop under the conditions of cropping which now prevail in North America or any European country, it is clear that the people of Argentina will be in a position to expand and develop that crop to such extent as they may deem profitable.

Herd of Holstein in the alfalfa and corn district west of Santa Fé near Rafaela.

**General Agricultural Status**: The development of agriculture in general thruout Argentina has been one of most phenomenal rapidity, exceeding that shown in any other South American country; and so far as exports are concerned, the development in lines of foodstuff production has probably exceeded that of any other nation. This is but natural because of location, climate, soil, and type of population. In no country were the people in better position to respond to the call of the World War for added production of foodstuffs, oils, and other necessary supplies. This, in part, accounts for the very rapid development in late years. Argentina, however, has always been agriculturally minded. It is not too much to say that this is partly due to the natural ranching facilities, and the great interest of the English investing public in the development of quality products and preeminently to their influence in aiding Argentina to develop a rather wonderful railroad system extending like the rays of a fan out of the leading export cities of the eastern provinces and finally centering in the great shipping port of Buenos Aires.

As in the case of other South American countries, the Argentine people are experimental-minded. All classes seem sold upon the idea of agricultural investigation and there has been in late years a rapid

development of the agricultural college idea, particularly as represented in agricultural investigation. There are a number of government experiment stations established thruout the country. Naturally

South American people are experiment station minded, especially in Argentina and Uruguay. Their influence is already being felt upon agriculture. This picture shows wheat plots at Santa Catalina Experiment Station in Buenos Aires Province. Agronomist Santani stands in a plot of Kanred wheat.

these experiment stations are working most intensively upon projects characteristic of the chief crops in the province in which they are located. As yet these stations have not given much attention to stock raising but are becoming well equipped for effective scientific work upon agricultural cropping features. There are efficient divisions of agronomy at Buenos Aires, at the institution known as Facultad de Agronomy, and extensive plants for agronomic work at Santa Catalina, Guatrache, Pergamino, and Las Delicias. The leading railroads have

North Dakota varieties of resistant flax photographed on agronomy grounds of the Faculty of Agronomy at Buenos Aires.

also taken an active part in these lines of agricultural investigation and have established a number of separate agricultural farms in cooperation with the Ministry of Agriculture, so that while they are furnishing the means for extensive investigation, the Ministry of Agriculture of Argentina delegates one or more agronomists to cooperate

in the investigations,—as at Sola, on the experimental farm of the Entre Rios Central Railway and at Barrow, Chacra Experimental de "La Prevision," near Tres Arroyas, in southern portion of province of Buenos Aires. There are also numerous sub-stations for agronomic work in Vegetal Genetics and Plant Pathology.

Flax and wheat plots, Experiment Station at Pergamino.

Furthermore, Argentina is not neglecting vegetable and fruit-growing, forestry or fish and game preservation situation. Special fruit and vegetable stations are being established in the major fruit-growing districts, particularly in Rio Negro, eastern Entre Rios, and

North Dakota varieties of rust-resistant wheat under test at agronomy grounds of the Experiment Station Guatrache, southwestern La Pampa, Province. Ceres in the foreground.

south Central Santa Fé. There are extensive plantations of apples, pears, peaches, oranges; and there is also a noted grape and wine industry in the Mendoza region, second only in productive output to portions of our great California districts. Argentina's oldest experi-

ment station is located near Concordia, Entre Rios, where extensive investigations are being applied to citrus fruits, in lines of breeding and culture extension. The nation is also not neglecting the sugar cane and cotton industries. Extensive cane and cotton plantations are being developed in Misiones, Chaco, and in the northwestern provinces.

**Agricultural Extension**: Argentina also has an efficient system of agricultural extension in operation. "Regional agronomes," appointed by the Ministry of Agriculture, are assigned to leading agricultural zones according to the type of work needing most expansion and efficient direction. These "regional agronomes" and their local offices function essentially as do our county agents, tho they seem to be working more specifically on special projects, according to zone in which located. These educational factors, efficient investigation and agricultural extension activities give promise of even greater agricultural and economic efficiency.

**General Statistics**: During the last decade the Ministry of Agriculture of Argentina has developed a system of economics dealing with

Pigs are a natural by-product of extensive creameries in the corn-alfalfa district. Notice a few of the tile-covered sheds provided for the young pigs at the Rafaela, River Plate Creamery. Some hundreds of pigs are here so housed as to run into extensive alfalfa pastures.

rural and agricultural statistics. Statistical data is given out by the Ministry of Agriculture under the title of "Anuario de Estadistica Agro-Pecuaria." This statistical matter has been, in the past, published in three sections dealing (A) Economic Statistics, Various, (B) Agricultural Statistics, and (C) Statistics of the Cattle Industry. These publications may be had upon application to the Ministry of Agriculture. They are generally used by business organizations, and are widely distributed in the provinces. They have undoubtedly aided greatly in centering proper information upon the important crops and upon various lines of industrial development.

Argentina is preeminently agricultural. The Minister of Agriculture summarizing for crop 1931 states that fully 97 percent of the products exported during the year 1929 arose from agricultural efforts. Of such exports, 65.6 percent came from direct culture of the soil and 31.4 percent from cattle products.

Larger pigs at the River Plate Creamery. All are furnished fine metal sheds with cement floors. The chief breeds are Poland China and Red Durocs.

The following tabulation gives a splendid conception of the cattle industry as it stands today.

| | Number of Animals | | |
|---|---|---|---|
| Cattle | 32,211,855 | Horses | 9,858,111 |
| Sheep | 44,413,221 | Mules | 1,039,420 |
| Pigs | 3,768,738 | Goats | 5,647,396 |
| | Poultry | 37,323,185 | |

Apart from the extensive meat industries and wool production a

Whether cattle, sheep, goats or pigs, the final home is some great packing plant (Frigorifica) located at some river or ocean port. This one is at Zerata on the Parana River.

rapidly developing *milk industry* bespeaks the intensive type of farming that is rapidly developing in the sea board provinces, as associated

with fine dairy herds upon alfalfa pastures. The year 1930 shows:—

PRODUCTION AND EXPORTATION

| | | |
|---|---|---|
| Butter | 33,568,388 kilos* | 23,204,000 kilos |
| Cheese | 15,394,229 kilos | 337,000 kilos |
| Casein | 13,993,779 kilos | 13,734,000 kilos |

* (1 kilo equals 2.2046 pounds.)

Receiving cream at River Plate Creamery, Rafaela.

For the crop year 1929-1930 approximately 19 million hectares (46,930,000 acres) were given to the culture of cereals and flax.

As stated in the 'Almanaque Del Ministerio De Agricultura De La Nacion, 1931' the following figures illustrate his conception of gradual expansion of the leading cereals and flax cropping. Of the 100 million hectares (247 million acres) usually assumed to be suitable for agricultural purposes, approximately 83 million hectares (205,010,000 acres) are assumed suitable for the production of cereals, flax and allied crops.

Assuming that the crop years of 1921-22 and 1929-31 are reasonably typical years, the following tables quoted from the Almanaque illustrate a gradual expansion in general agriculture and in the production of the leading cereals and flax.

TOTAL AREAS UNDER CULTIVATION, (EXCLUSIVE OF ALFALFA)*

| Year | Hectares | Acres | %** | Year | Hectares | Acres | %** |
|---|---|---|---|---|---|---|---|
| 1921/22 | 12,699,601 | 31,368,014 | 100 | 1925/26 | 17,887,219 | 44,181,430 | 141 |
| 1922/23 | 14,150,158 | 34,950,890 | 111 | 1926/27 | 18,415,047 | 45,485,166 | 145 |
| 1923/24 | 15,383,113 | 37,996,294 | 121 | 1927/28 | 19,211,114 | 47,451,451 | 151 |
| 1924/25 | 16,445,166 | 40,619,560 | 129 | 1928/29 | 20,825,517 | 51,439,026 | 164 |

* Acreage under cultivation, crop year 1921/22 placed at 100 percent.
** Figures in these columns indicate the augmentation by years.

AUGMENTATION OF CROPPING AREAS 1922 TO 1930, SHOWING PERCENT OF INCREASE

| Crop Years | Wheat | Corn | Flaxseed | Oats | Barley | Millet |
|---|---|---|---|---|---|---|
| 1921/22 | 100 | 100 | 100 | 100 | 100 | 100 |
| 1922/23 | 114 | 107 | 111 | 124 | 97 | 151 |
| 1923/24 | 121 | 116 | 139 | 130 | 110 | 167 |
| 1924/25 | 125 | 125 | 162 | 126 | 133 | 160 |
| 1925/26 | 135 | 145 | 159 | 152 | 145 | 207 |
| 1926/27 | 135 | 144 | 187 | 159 | 158 | 225 |
| 1927/28 | 145 | 146 | 181 | 150 | 191 | 370 |
| 1928/29 | 160 | 161 | 178 | 178 | 216 | 527 |
| 1929/30 | 144 | 190 | 182 | 181 | 234 | 534 |

TOTAL AREAS UNDER CULTIVATION, ALL ARGENTINA, CROP 1929/30

| | Hectares | Acres (Approx) |
|---|---|---|
| Wheat | 8,285,600 | 20,465,432 |
| Corn | 5,647,400 | 13,949,078 |
| **Flaxseed** | **2,869,500** | **7,087,665** |
| Oats | 1,510,558 | 3,731,078 |
| Barley | 586,972 | 1,449,820 |
| Millet | 522,450 | 1,290,451 |
| Birdseed | 23,460 | 57,946 |
| Rice | 3,685 | 9,102 |

TOTAL PRODUCTION IN METRIC TONS

| | Tons | Bushels (Approx) |
|---|---|---|
| Corn | 6,328,923 | 249,156,136 |
| Wheat | 3,740,414 | 137,435,278 |
| **Flaxseed** | **1,327,293** | **52,252,681** |
| Oats | 991,282 | 68,293,134 |
| Barley | 351,219 | 13,826,739 |
| Millet | 111,794 | 5,130,455 |
| Birdseed | 11,487 | 633,103 |

*1 metric ton (tonelada), 2204.6 pounds.

Wool carts in eastern Entre Rios, on highway, near city of Concordia.

Limited home consumption due to small total population naturally allows Argentine exportations to approximate closely the quantity produced.

Data available during the past decade shows rapid gradual expansion of this export trade only varied in amount according to crop fluctuation in production. A late report on the flax crop of 1930-31 shows over 70,000,000 bushels exported to date of November 6, 1931.

The following tabulation indicates the approximate volume for the three leading small grains:

EXPORTATION, WHEAT, CORN, AND FLAXSEED
In
Metric Tons

| Crop | 1929 | 1928 | 1927 |
|---|---|---|---|
| | Tons | Tons | Tons |
| Wheat | 6,613,341 | 5,295,385 | 4,225,494 |
| Corn | 5,047,792 | 6,372,181 | 8,343,597 |
| Flaxseed | 1,617,488 | 1,944,402 | 1,894,565 |

I have particularly emphasized corn, wheat and alfalfa culture and called attention to the great emphasis placed upon the growing stock and dairy industries because it is well known that these factors constitute a proper base for cereal and small grain cropping.

**Development of Flax Growing in Argentina and Possible Expansion:** The Argentine flaxseed crop has apparently developed most rapidly along the sea coast and river lands—the heaviest and most fertile in Argentina. Even yet, there are certain officially designated agricultural zones in Santa Fé, Entre Rios, and North Buenos Aires

Typical threshing scene in flax zones of Santa Fé, Rosario and eastward.

which show the flax crop as of first importance. In other zones it is listed as second in importance to corn, cattle and pasture. The fact that approximately a semicircle drawn around the city of Rosario to the west and south with a radius extending to approximately the northwest corner of the province of Buenos Aires includes the chief corn belt, the heaviest flaxseed production, and the most extensive alfalfa fields and pasture lands for stock production, in itself, should indicate a lesson in flaxseed production not easily overlooked. The results there obtained constitute proof that the linseed crop best pays for itself when it is placed upon the heaviest and most fertile lands

in close association with pasture, cattle, corn and alfalfa. As noted elsewhere under other topics, this close association of flax cropping with corn production and the cattle industry not only affords the cattle men two annual cash crops to aid in the development of the cattle industry but affords to flax possibilities of higher production because of deep tillage and the splendid soil texture which follows extensive trampling and pasturage.

The "Cook" car and its paraphanalia is seen thruout Argentina.

As wheat and flax were the earliest developed of Argentine cash grain crops, it is worth while to note their comparative development. The cattle industry and its export returns preceded both flax and wheat and, as elsewhere indicated, has only in late years come into more intensified association with the three cash crops, wheat, flax, and corn.

In Argentina, as elsewhere, wheatlands even yet may best determine the final range or limits of flaxseed production. Data available indicate that wheat growing for export purposes somewhat preceded flax production, but was of rather slow development. However, the acreage reached 2,049,683 hectares, or 5,062,717 acres during the crop year of 1894-5. In 1916-17 the area expanded to 6,511,000 hectares. From that date, there has been gradual expansion until in 1930-31 the acreage is given at 8,625,200 hectares. Thus, the wheat acreage of the entire country, as seeded, is now placed at approximately 20 to 22 million acres.

The following table* shows comparative statistics in hectares seeded to flax by provinces, 1894-1930-31 inclusive.

FLAXSEED PRODUCTION BY YEARS AND PROVINCES*
In Hectares Seeded

| Year | Buenos Aires | Santa Fe | Cordoba | Entre Rios | Pampa | Other Provinces | Total for Country |
|---|---|---|---|---|---|---|---|
| 1871/72 ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| 1887/88 ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| 1894/95 ..... | 64,756 | 266,606 | 35,877 | 19,665 | ..... | ..... | 387,324 |
| 1916/17 ..... | 170,000 | 528,000 | 350,000 | 200,000 | 30,000 | ..... | 1,278,000 |
| 1923/24 ..... | 459,696 | 801,000 | 340,000 | 434,500 | 77,250 | 14,100 | 2,126,546 |
| 1924/25 ..... | 626,848 | 862,500 | 365,850 | 549,300 | 121,400 | 32,800 | 2,558,698 |
| 1925/26 ..... | 564,600 | 875,800 | 361,050 | 605,000 | 72,000 | 31,000 | 2,509,450 |
| 1926/27 ..... | 558,000 | 994,500 | 389,300 | 653,700 | 75,000 | 29,500 | 2,700,000 |
| 1927/28 ..... | 610,000 | 970,000 | 430,000 | 680,600 | 131,000 | 33,400 | 2,855,000 |
| 1928/29 ..... | 590,100 | 1,061,500 | 472,600 | 711,800 | 74,800 | 42,250 | 2,952,800 |
| 1929/30 ..... | 538,200 | 1,094,850 | 414,600 | 720,200 | 54,900 | 46,250 | 2,869,000 |
| 1930/31 ..... | 614,050 | 1,024,300 | 444,900 | 823,000 | 30,700 | 58,950 | 2,995,900 |

* From Bolsa De Comercio Del Rosario, year 1930, page 241. (See map on cover, page 1.)

From these figures, it is evident that flax cropping, as in the case of wheat, experienced rapid development during the World War period, and that there has been to date, a gradual expansion of the areas

The owner of this straw-burning outfit, a colonist, in central Entre Rios had a field of 2000 hectares of flax with the stacks arranged in groups.

planted. It is apparent that the chief immediate expansion is as yet to the northward and eastward into extensive areas of lighter soil type and heavier rainfall. These areas are either new to tillage or are as yet used as native grazing lands. Some of the finest flaxseed observed was produced upon such native lands which had been but lately broken up after use as sheep or cattle ranges of long standing.

This is particularly true of north Santa Fe and central Entre Rios. The lands of northern Santa Fe are often overcast by a type of drifting or sandy soil, yet, when plowed, there seems to be a satisfactory subsoil of extended depth. The native vegetation tends to low-lying scrubby trees and growths of cactus in various districts. These scrub lands interspersed with grassy swamps, when open to flax culture, produce the finest quality of seed that is shipped from Argentina. *The extent to which flax may be pushed to the northward under subtropic conditions would, alone, make it possible to approximately*

*double the area now in use.* I am told, however, that one of the limiting factors in this region, strange as it may seem, is at times that of drought at planting time.

Home of manager handling 2000 hectares of flax. The cooking is done in the open. Notice the beehive-like stove to left of the main building.

As with our northern plains region, these new land areas are at times subject to extensive grasshopper invasions so that these conditions of drought at certain periods and of grasshoppers and other destructive insect pests, tend to limit the certainty of uniform yearly production.

Westward and southward, in provinces of Cordoba, San Luis, and La Pampa and southwestern Buenos Aires, there are nevertheless great areas of lands now used for wheat and pasturage, native and cultivated, into which the flax crop may quite as readily be introduced as in any of our western plains region.

Ignoring these great expanses of new lands immediately at the north in Santa Fe, Cordoba, Entre Rios and Corrientes, *Argentine wheat areas and yields indicate large possibilities of immediate increase*

*Negative by Dr. C. A. Bahre, Buenos Aires*

Country highway in north Santa Fé, trees on left injured by grasshoppers, flax field on the right.

*in flaxseed production, should it be deemed advisable by Argentine growers, for as shown by the comparative statistics on wheat, corn, alfalfa and pasture, there are yet great possibilities for expansion of flax culture upon lands of highest agricultural value, under climatic conditions which are exceptional for the production of the crop.** (See tabulation on pages 24, 35, 36 and 39 and the map on cover page 1.)

Since this was written, a November report places the crop of 1931-32 now nearing harvest at 8,638,000 acres. This is more than 1,000,000 acres increase over the crop of 1930-31.

**Methods of Culture with Flax:** As in the case of wheat, methods of preparing the seed, preparing the soil, seeding and harvesting flax

*Negative by Dr. C. A. Bahre, Buenos Aires*

Northern Santa Fé. Soil is being prepared for flax.

do not differ largely from those followed in the United States. On the large estates the chief difference is in the larger types of machinery used, as headers, combines, harrows, disc plows, rather than in the manner of using the machinery. After careful examination of fields prepared for seeding flax and stubble lands after being harvested, one finds that with them the ground at seeding time was left in even rougher condition than with us. After the entire season of growth from seed time to harvest, such stubble fields in Entre Rios and eastern Santa Fe, and in most parts of Buenos

A load of flaxseed on a road approaching the town of Pergamino.

Aires province, showed a lumpy condition which even the extra heavy rainfall had not broken down. In the newer land regions a very large

percentage of the flax is seeded by broadcasting methods, simply harrowed in, or worked in with heavy floats. Rollers and packers are not as extensively used as with us, tho I saw many home-made types and some culti-packer types. Three factors there govern the preparation of the soil. In the lighter land regions of lesser rainfall, heavy winds and dust storms preclude the crushing up of clods and powdering of the soil by plane rollers, floats, etc. In the provinces of heavy rainfall and heavy soil types, packing of the lands is not necessary because the rainfall in most seasons will insure sufficient moisture at the top and from below upward. Even in the corn lands, which are often used for flax, levelling of the ground and packing as recommended with us, is not there generally followed. In the first place their method of "laying by" the corn by a deep listing or central single shovel winged plow leaves too deep trenches to make such methods of seeding successful. Thus corn lands as used either for cereals or flax are usually shallow plowed or deep disked and harrowed, either once or twice previous to seeding. Such methods in the main corn districts are said to essentially assure good yields of flaxseed. It must be understood, however, that in these regions the rainfall varies from 30 to 60 inches during the main growth season.

Farmer and helpers drying grain on the roadside, a characteristic scene. Heavy downpours of rain make it necessary for them to dry the grain before they try to sell it at the local warerooms. This was at Rosario Talla.

Wheat stubble lands as far as I could learn are seldom if ever simply shallow disked as sometimes done here, but are plowed or deep disked and harrowed preparatory to seeding flax. In southern Buenos Aires and in western portions of the Province of La Pampa, the black and heavier pasture lands are with them often selected for flax.

In case of planting in cereal stubble such as wheat, oats, barley, flax, the processes thruout from seed time to harvest are particularly characteristic of such processes as would be found in our semi-dry

land plains of North Dakota, South Dakota, Montana, tho in the case of weedy lands preliminary discing of the stubble often precedes the plowing to insure destruction of weed seeds.

On the Southwestern plains the crop is subject to vicissitudes of development and harvest quite similar to our conditions. Here the Argentine varieties of flaxseed are apparently not quite suited because of the natural short growth of straw that these varieties make in case of drought or other slow-growing conditions. One outstanding feature of the value of the Argentine varieties, however, is that the larger weight and volume of the individual seeds probably largely account for the general success in procuring favorable stands following seed time upon rather rough lands. These varieties when of good, mature, plump uninjured seed quality always show a rugged ability to emerge from the seed bed and in the absence of disease give a sturdy first growth. Furthermore in these large seeded varieties, the short straw, also supports a sturdy root growth. The rate of seeding ranges from 45 to 60 kilos per hectare, about 40 to 50 pounds per acre.

*Negative by W. T. Sheats, International Harvester Co., Conception del Uruguay.*
Drying grain by means of fanning mill and shovelling preparatory to loading a ship at Diamante.

Harvesting methods cover every type of reaping and threshing from most extensive types of headers and combines to ancient straw-burning large cylinder threshing machines. As in the case of wheat and corn as yet all flaxseed is handled direct from the thresher in rather high-quality burlap bags which may stand for days in the field. In rainy districts the grain is usually at once carted or trucked to local railway storage warehouses or at such storage points is placed under heavy rain-proof canvas covers. The ricks of bags simulate, as it were, a continuation of the warehouses. One sees thruout the harvesting and shipping season flax being dried by hand in the wind upon canvas along the highways and upon large expanses of canvas at the warerooms at local shipping points and at the great warerooms at the ocean and river ports. American importers often wonder why Argentine flax is seldom of even color, grade and moisture content.

In other words, that it contains so much *"manchada"*—dark colored, light weight, scabby, scaly seeds in bulks of otherwise magnificently colored mature seed. This damaged type seldom is due to frost, not often to disease, but commonly to the influence of moisture and rain, wet stack bottoms, grain wet in the bags, etc., giving a type of damaged seed which eventually becomes intermixed with the good seed for export.

*Negative by Dr. C. A. Bahre, Buenos Aires.*

As in North Dakota and Minnesota large stacks of flax straw are to be seen everywhere at threshing time.

Fanning mills at shipping points, local warerooms, and at export warerooms seem to be quite as commonly used for drying and mixing purposes as for removal of weed seeds, mustard, etc. While I would not vouch for the fact, it is my observation that most of the weed seeds are also sold. This, however, is nothing new to citizens of our Northwestern states. *Flax, there and elsewhere, is one of the most abused of crops. It seems to be able to stand more punishment, whether in cropping or in marketing, than almost any other seed crop.*

*Negative by Dr. C. A. Bahre, Buenos Aires.*

An extensive attempt is being made in Argentina to develop a fiber industry around the flaxseed crop. Baling flax straw in northern Santa Fé for transport to a fiber plant at Esperanza.

**Cropping for Flax Fiber Production:** The growing of flax fiber varieties for weaving and development of a linen industry in South

America as in North America has never gone beyond sporadic efforts of certain fiber propagandists. Climate and soil would assure the possibilities of abundant production of fiber varieties of flax. However, since the development of the great cotton industries, the flax fiber and linen industries of Holland, Belgium, Ireland seem quite able to hold the field of adequate production.

**Fiber from Flaxseed Varieties:** In Argentina as in the United States the vision of possible utilization of the fiber available in the straw of the seed crop has been constantly before the growers and citizens. As with us, there are yet great stacks or masses of threshed straw rotting, plowed under, or burned. This is not so much a problem to those in the cattle grazing zones. The straw to a certain extent is used in similar manner to the other types of straw for roughage, sheds, and bedding.

Nevertheless, there now stands in Argentina the most expensive, extensive and able attempt at utilization of the fiber from the seed bearing crop that has ever been attempted in any country. This retting and spinning plant having a capacity of 20,000 kilos of yarn per

Some of the yarn and twine products as made at the plant known as Fibralina, town of Esperanza, Santa Fé. Dr. C. A. Bahre, inventor of the process of retting, degumming and spinning, is shown holding some of the yarn and twine.

day is located at Esperanza, in eastern Santa Fé, in one of the finest flax producing districts where there are colonies of Swiss and other competent flax growers. This great plant under the factory name

*Fibralina* was developed following a 10-year period of investigation, instigated by the German financier, Stennes.

The plant is of steel construction thruout and is equipped with the most efficient and latest types of electric driven retting, degumming, carding, and spinning machinery. It stands idle after a period of operation not exceeding 3 months, with thousands of bales of splendidly retted straw and some thousands of kilos of different grades of high quality yarns and twines, ready either for weaving, twine or rope construction, stored in the warerooms.

Apparently there is no reason why this plant should not be operated not only to make all the twine and bagging that Argentina needs —materials for its great grain handling business, but for canvas, towelings, rugs and in other lines of manufacturing and commerce; but as in case of other industries started just at the close of the War, the management was caught by the period of depression and the plant was thrown into the hands of a receiver, to be sold for a comparatively small debt.

To the writer it seems unfortunate that such a plant should not be able to run until at least a sales organization was established to ascertain whether the fine products that were there being produced could not in actual fact compete with cotton, hemp, jute, and sisal.

**Flax Varieties:** As is well understood, the use of the word "variety" in flax cropping has been of but late development. Even in Russia and Holland and other nations in which flax for fiber purposes has been for centuries under constant culture one finds such expres-

Heavy rains necessitate covering the grain-laden trucks in the manner indicated. These are at the port of Santa Fé.

sions as "blue flowered Riga" and "white flowered Dutch," etc. Yet in this standard fiber crop there has never been any proper separation into varieties. In flax cropping for oil production, it is only within

late years that any attempt at separation into varieties or strains has been made in any country. Whether for fibre, seed or oil production, one is probably not justified in attempting to specify flax cropping by variety. Such socalled "varieties" are perhaps more properly designated as production strains. Of these there are many of varying type according to the lines of cropping, selection and development practised.

In Argentina also the word variety is applied loosely to certain generalized types as "Flor Blanca", "Lino Grande", "Malabrigo", "San Carlos", "Linata", etc. These terms at best, excepting only certain experimental types under trial at the various experiment stations, are chiefly only known to commercial men as representing certain forms and qualities of commercial seed.

Generally speaking Argentine types of seed are of intermediate size, between small-seeded Russian oil types and the short-strawed large-flowered thick-rooted large-seeded Sicilian types,—a sort of survival selection due to joint action of climate, soil and commercial selection of seed types for production and export. Reliable history for such varietal names there as in Europe is not available. In commerce and general cropping there is a certain uniformity of type—as to seed and stem growth. Brown-seeded types of rather characteristic Argentine form have gradually predominated in commerce. In the fields one does not find a wide variation in type but often there are admixtures of white flowers, pink types, small-seeded, medium and large seeded types variously mingled as are found also in the bulk seed of commerce.

Large-seeded types under the selection names "San Carlos" and "Malabrigo" prevail in the north and east, the smaller-seeded forms characteristic of small-seeded Russian oil types are more commonly found in the south and western semi-dry lands, where a greater height of straw seems desirable.

Unlike our Northwestern conditions there seems to be some evi-

When storerooms are full this is the way the grain is stacked preparatory to covering with canvas.

dence of field or natural crossing in the more humid Argentine zones. This factor, however, awaits actual demonstration. Commercial mixing and artificial crossing is, perhaps, all that is necessary to account

for the variations noted in individual fields and in the commercial seed products.

**Argentine Flaxes of Short Form:** The Argentine varieties and strains of flax even in their own best environment, while of sturdy growth, must be recognized as of comparatively short straw type. While they reach a fine height of straw in districts of even humidity, high rainfall and high quality of soil in Northeastern Argentina, in all districts of irregular temperatures, atmospheric and soil moisture, they drop to type and height of straw similar to their growth with us. In large districts of Cordoba and Buenos Aires, and other semi-dry land areas, these varieties nevertheless are successfully grown and successfully harvested because proper care is taken in preparation of a level seed-bed on lands approximately free from weed seeds. *These large-seeded varieties facilitate the work of proper seed cleaning before sowing; and are there easily harvested by headers and combine threshers.*

**Flax Diseases, Insect and Weed Pests:** Flax is one of the most cosmopolitan types of farm crops, world-wide in its distribution, yet has for the most part received slight special effort likely to do more than bring about a sort of survival of the crop and its various ills and pests. These have apparently followed the crop along with the frontier farmer. Thus, one finds familiar diseases, insects and weeds,

Flax bags are sampled approximately six times before they reach the hold of a ship in export. These bags are being weighed and the representative of the exporting firm is taking a sample from each bag before they are placed into a local wareroom or rick.

familiar methods of cropping, etc., in each country. Argentina is no exception; but, as elsewhere, climate and soil types emphasize some pests and minimize others.

Flax rust brings about very slight damage as to seed shrivelling, loss of weight, etc., to large-seeded Argentine varieties, but in the small-seeded varieties, such as NDR114 so far as grown, North Dakota variety known as Linota, and other types of small-seeded flax of Russian origin, often suffers quite as much damage as with us. This seems to vary largely with temperature, humidity and the rainfall conditions, date and time of seeding in the different cropping zones.

In the case of *Pasmo,* shrivelling and scabbing of seed is at times extremely destructive. This seems to follow as a matter of date of seeding and maturity in various zones, and, so far as observed in the crop year 1930-31 was particularly destructive in Entre Rios and north Santa Fé. The early planted flax had matured—splendid types of seed as harvested in November and December. The stubble and straw in these early planted areas showed that while *Pasmo* had been present, it had reached destructive form only on the lower stem or stubble portions and did not produce noticeable shrivelling and scabbing of the seed. The disease had apparently only hastened maturity, while in adjoining fields which had been planted one, two or three months later, there were heavy growths of straw the lower portions of the stems of which were essentially free from *Pasmo* and remained green and sturdy with powers of elongation after the upper half of the straw, blossoms, and seed bolls were blighted or killed. Late planting plus high tempera-

Typical rick of grain at wharves at Bahia Blanca.

ture and atmospheric moisture had facilitated an excessive attack of *Pasmo* which had spread from the stubble of the early crop to the late plantings just preceding or following the blossoming period. Farmers

explained that had they planted all of their flax at the same time that they planted the first, an extra stand of straw such as shown by the late crop would have netted them even greater yields than they received from the first plantings. In fact, many late crops were so injured as to reduce yields to less than one-half and in some cases less than one-third normal yield.

While there were evidences of the *fusarial wilt diseases* in the soil, seed and crop in all districts in which flax cropping is generally consecutive. Wilt seemed to be materially destructive chiefly only in the semi-dry land zones.

**Insect Pests:** Grasshoppers, crickets, cutworms, armyworms, wireworms, etc., in mode of attack, there as here, were found for the most part to be of similar type with the exception of a small sort of moth-like butterfly, the larva of which worked inside the bolls and flower buds doing great damage to otherwise promising crops. In this case, large fully-formed bolls were found to be wholly empty—the larva having eaten out the interior and emerged by a round opening on the side or near the apex, approximating about one-sixteenth inch in diameter, and when the crop was, as yet, immature.

Weeds, such as mustards, were found to be widely disseminated with the flax crop but also appeared to be most destructive in the marginal lighter land districts. Pigeon grass types (*setarias*) are commonly present but these and other weed types do not seem to prosper in the northern heavy land flax zones—where the farmers practice best methods of soil preparation preparatory to seed time. The longer period available for the preparation of the seed bed and favorable growth periods for the first growth of the sturdy-rooted Argentine seed types perhaps, in part, account for the apparent slight damage from weeds, such as pigeon grass, goosefoot, and pigweed types in the northeastern flax zones.

**Resistant Varieties in Argentina:** We have been interested whether there might be found in Argentina types of large-seeded flax of sturdier root growth, more resistant to disease than North American grown strains. This seemed possible because farming operations there, with flax, for a long time proceeded along unusual hard conditions of production. Some types of seed if used over and over on the same lands and under the varying types of soil and climate might develop strains resistant to conditions even more rigorous than our flax cropping now requires.

Argentine seed has usually come to us as commercial samples. These have shown rather uniform reactions to Northwestern soil and climatic conditions, and generally the decision of our farming public and experimentalists have been against the continued use of Argentine seed. Tho Argentine seed has been planted in North Dakota since 1890, usually those that have grown it have discontinued because year by year their results have not been more promising than from our own varieties. The chief objection urged has been that the stand of straw is too short to compete with heavy weed growths under our conditions in the Red River valley lands and difficult to harvest in the

semi-dry land regions. Nevertheless, such empirical knowledge is not a proper basis upon which to decide the entire merits of Argentine seed.

At the great river ports, after the warerooms are all full extensive ricks of grain in bags line the wharfs.

**North Dakota Seed in Argentina:** North Dakota flax strains have been tried in Argentina and Uruguay and according to the reports of their experimentalists not found satisfactory for their conditions. NDR114 and Linota were described as being of too weak straw, too small seed type, and very readily destroyed by rust. While there, I had opportunity to confirm these Argentine conclusions. In the case of Linota they had previously increased and widely distributed to farmers. Wherever seen, this crop was badly injured by rust, but was standing up with regard to wilt and *Pasmo* approximately as well as the native crops.

Long lines of trucks, carts, and wagons loaded with grain are to be seen at local shipping points. This one is at Rosario Talla, Entre Rios.

In preparation for these Argentine studies I had previously forwarded the Director of Agricultural Investigation in Argentina standard samples of NDR114, Linota, Buda, Bison, Rio, and other selection

types. The Director had caused these to be distributed to a number of sub-experiment stations in Argentina where they were carefully seeded in the agronomy plots in normal association with the standard Argentine variety "Malabrigo." I was able to examine the resultant growth from these plantings at four of the leading experiment stations—Guatratche, Santa Catalina, Buenos Aires, Pergamino, and two points in the province of Entre Rios where NDR114 and Linota were under trial.

The results of such examination of the crop were not encouraging to the hope that from Argentine varieties, taller and sturdier types may be obtained than Bison, Buda, and Rio. Generally speaking, these North American varieties, particularly Bison and Buda, stood under like conditions several inches taller than any Argentine variety or other Argentine selection. They also retained their comparative strength of growth relative to each other under the new soil and climatic conditions. Even the type *Rio* stood quite as high as the best Malabrigo.

As to **disease resistance** on wilt-sick soil they showed better resistance than any adjoining Argentine selection. None of them or any Argentine variety was wholly free from the attack of *Pasmo.* Bison and Buda as recorded by the agronomists in charge and as observed by me on this first year's trial seem to show more than usual resistance to *Pasmo;* this was particularly true at Pergamino and Buenos Aires in the case of *Buda.* I am informed that these strains will be held

Dr. Alberto Boerger, director of the Experiment Station at the Institut Fitotecnico, "La Estanzuela", explains the character of the soil of eastern Uruguay to the writer and his associates. Dr. Boerger is the man at the left and is probably the ablest agriculturalist in South America. Thru his plant breeding work and seed distribution he has had large influence upon the development of cereal grains and flax in Argentina.

under further trial and hope eventually to be able to report data by Argentine agronomists on the point as to whether they continue to hold such favorable disease resistance under that environment.

**Flaxseed From Other Southern Countries:** At the present time little, if any, flaxseed may be expected from any other South American or Central American country than that of Uruguay, which, as shown by the map on the cover page, lies directly in the flax zone corresponding most nearly to Entre Rios and Santa Fé. A considerable tonnage of seed is already being exported from the River Plate ports of Uruguay, much of which because first loaded on small steamers, scows and lighters on the Uruguay River may be reshipped in ocean liners out of Montevideo or even Buenos Aires. There is also apparently a considerable effort being made in southern Brazil to grow flax in such regions as are suited to wheat.

The irrigated regions of Mexico have already demonstrated that splendid crops of flaxseed may be grown. During the cropping year of 1930-31 we have a report from 741 acres of Bison flax planted by 10 individual farmers. The type of straw produced under their semi-tropical conditions and irrigation methods is well illustrated below by the bundle forwarded to us from the crop of 1930. The straw showed no signs of disease whatsoever and stands 42½ inches high. This is from 12 to 16 inches taller than Bison grows with us under best Red River Valley conditions.

Bison flax from Sonora, Mexico.

Again it is seen in these sub-tropical regions of Mexico that there is a possible wide choice of planting and harvesting time. "Earliest planting date was November 25." "Latest planting date was February 10." "Harvest was started May 25 and completed July 4." "Gross yield per acre was 12.3 bushels, net yield 10.8 bushels." Gross yields per acre in crop planted prior to January 1, 17.1 bushels." Highest yield recorded was on 18½ acres with an average of 26.2 bushels per acre." My informant, Mr. C. B. Gwathmey reports that 7,500 acres will be planted in the Yaqui Valley in the season 1931-32.

I found that considerabel amounts of flax are grown in certain valleys of Peru, particularly by the natives for fibre purposes and was told that linseed oil is extracted in a few small plants.

Enough has been done in Chili to prove that so far as their small areas are concerned, their production of flaxseed per acre could be made to equal that of the highest known yields, but the needs and trend of their agriculture will naturally be along other lines of more intensified agriculture and horticulture.

From this resume I think it is safe to assume that for some years the bulk of the flaxseed of the western continents will naturally come from the United States, Canada, and the regions immediately surrounding River Plate shipping ports.

**Grain Handling and Transportation:** Rural conditions in Argentina, to one familiar with North American home life, and improved

rural conditions, constitute a continual surprise. In travelling over the agricultural zones, one meets with farming of the highest grade and order of productivity, but is continually astonished at the meagre type of farm homes and buildings. It is a country of wide well-fenced highways, most of which are yet but rutty trails. Even here, one suddenly comes upon long sweeps of well-graded highways on which automobile trucks are rapidly taking the place of the high-wheeled carts and farm wagons, characteristic of the more distant rural places. It is a country of a few great commercial cities or shipping ports on the deep waterways of the Parana and Uruguay Rivers

Typical 16-horse "carro", capable of hauling more grain than the best truck and its trailer. This one was seen near Tres Arroyos.

and ocean front and a series of low one-storied adobe or brick constructed rural towns and villages, with few if any rural buildings which may be spoken of as country homes intervening.

Storage on the small farms, excepting corn cribs with thatched roofs in the corn zones, is almost nil.

The highways in the chief cropping zones are especially well fenced, a natural necessity of extensive cattle and sheep farming.

In rural villages, adobe construction, whitewashed walls and slight, if any, sidewalks, is the rule. No lawns or grading of land about the houses exist. Each home or business place insofar as it may have a yard and garden incloses it in the form of patio inside the building. High adobe walls, and sturdy gates forbid to great freedom of entrance.

Outside the main agricultural zones one travels for miles on the highways without seeing other signs of habitation than the estancias in the distance or now and then a squalid hut or type of shed, roofed by miscellaneous scraps of metal sheathing, bamboo or other types of thatch.

In zones of more profitable colonial farming, occupied and run by European immigrants, the homes on the land are not usually great improvements over the types of native shacks, tho they are more extensive. The reason for all this probably rests in the scarcity of timber and the high price of lumber, metal, and cement construction.

**Railways**: Regardless of all this, Argentina has rather splendidly ballasted railway lines exceeding 23,000 miles in extent, leading like the rays of a fan into the great port of Buenos Aires, closely and properly associated with the other large oceanic and interior cities. These are chiefly privately owned and financed by foreign capital, and efficient handling of rail traffic partly accounts for the fact that a *comparatively small individual population is able to handle the extensive outputs of grain that goes into foreign commerce.*

High-wheeled carts or wagons can travel on highways where the automobile cannot yet go. This year, 1931, because horse transportation was very cheap, these carts competed extensively with the trucks even upon high quality roads.

Loading stations with local warerooms and storage bases for canvas-covered ricks of bags are rather closely located along each line. The storage warerooms are of steel and galvanized iron construction of uniformly one-storied type. In the past there has been but slight elevator construction other than at Buenos Aires, Bahia Blanca, Rosario and Santa Fe, and the elevators, with exceptions of new ones now under construction, are of small capacity.

In most local warerooms all grain storage is in burlap bags as it comes from the threshing machines. The bags are carefully stacked in the warehouse in the form of regular ricks such as habitually made on the exterior when there were no warehouses and as yet done when storage is needed in extension of the present warerooms.

Such cleaning, grading and drying of grain as may be necessary takes place upon extensive areas of canvas, by shovelling in sun and wind, or by running thru hand-driven fanning mills.

**Stacking of Grain:** One would not have a fair conception of the Argentine agricultural grain handling and storage if the wonderful method of storage in stacks previous to threshing is left out of

In the eastern provinces heavy rainfall makes it necessary to properly stack grain. Flax or wheat ricks such as this are always thatched in manner shown. On flax stacks, usually wheat or wild oats are used for thatching with the heads turned downward.

consideration. These properly built and carefully thatched stacks or ricks stand for months without material deterioration of the grain except only in regions where possibly inundation of the stack bottoms may at times occur after heavy rains.

Even under these conditions of storage and cartage, it is safe to say that with the exception of the grain lost in flooded areas thru torrential rains, little if any flaxseed is lost to commerce or exportation because of the present method of bag handling and storage. In the case of wheat and possibly in the case of flax, lack of proper farm and local storage on track largely account for softer grades of wheat and higher moisture content in flax than would ordinarily occur. Atmospheric humidity in the chief agricultural zones, aside from actual rains, is usually high compared to that of southwestern plains in Argentina or those of North American Great Plains. This humidity borne by the trade winds far into the interior is of very considerable moment in tempering the winter temperature and the hot winds of summer and usually insures seasonal rains.

**Short Haul:** One of the very great advantages which Argentina possesses over many other grain and meat exporting nations lies in the short haul from local points of production to the deep water ports. The present agricultural zones furnishing the bulk of agricultural ex-

ports are chiefly delimited about a curved line running from Bahia Blanca in a more or less tortuous manner thru the city of Cordoba, to the point known as Resistencia on the Paraguay, thence across

Loading tramp ship from trucks in Entre Rios.

Corrientes to approximately to the northwest boundary of Uruguay. It should be noticed that the distances to the deep water ports on the Parana and Uruguay rivers to Buenos Aires or Bahia Blanca on the ocean do not of necessity greatly exceed at any points more than approximately 200 miles. Indeed, most of the grain, cattle and products produced for export are within short wagon or truck hauling distances.

During the entire grain-threshing period and corn-picking period extending over several months, one sees long caravans of "carros" and "carreteria" (high-wheeled wagons and carts) according to the quality of the road, intermixed with modern trucks, making for the deep water ports on the Parana and Uruguay Rivers. It is not an uncommon sight to see these conveyances loading grain direct into ocean going vessels at the leading shipping ports. During the export season the Uruguay River readily furnishes transportation for boats having a water draught of 15 feet thruout the entire length of the river front of Entre Rios on the east. The ports of Diamante, Rosario, Parana and Santa Fe on the Parana furnish dockage for ocean-going steamers of 30 feet draught or more. Other vessels of lighter draught readily navigate the entire length of the Parana River to the junction of its great tributary, the Paraguay.

Coupled with this great advantage of short railway haul and deep ocean-going transportation, estimated as approximating one-tenth cost of railway haul, the Argentine crops, whether of flax, wheat, corn or

other cereals, wool, cattle are mainly handled by a very limited population.

Loading river tramp steamer direct from farmers' carts at Diamante.

**Elevator Construction and Bulk Handling**: There is an evident desire on the part of Argentine commerce that a change be made in the methods of grain handling, as they term it, to escape "the expensive system of hand labor." There has been continued agitation there for the construction of extensive terminal elevators and also for large elevator construction at leading rural railway points. This feature of development is already under way at the chief export ports. Large terminals are being constructed at Rosario and Bahia Blanca and preparation being made for same at Santa Fe, and other River ports. These, undoubtedly, will prove a great boon to the export trade because of the facility of handling preparatory to preparing proper grades for export thru efficient elevation, drying, cleaning and ship-loading. The old practice of loading flax only in bags in ocean-going steamers is gradually being abandoned. Only part of the cargoes now coming to North America are so bagged. However, the debaging process is also expensive. Elevators will certainly speed up and facilitate proper storage at the ports, and relieve congestion at rural points.

The construction of country elevators at rural points, however, and consequent handling of grain in bulk thruout all districts is a much greater problem. This would normally set aside the very efficient handling in bags now done by hand labor, and of necessity substitute expensive construction and handling by machinery. At present, few if any farm wagons in Argentina are properly constructed

for cartage of grain in bulk. There are no local storage places upon the farms and even the railway transportation would need to change from bag handling on open cars under canvas to properly recon-

Large cooperative elevator under construction at Rosario.

structed cars for bulk handling. Such methods of bulk handling after completion will undoubtedly result in greater speed of handling much larger bulks for export. If the process proves to be economically

This elevator under construction at Bahia Blanca—when finished, will be one of the largest in the world.

sound—and in fact cheaper—it will undoubtedly make Argentina the greatest of grain exporting nations. At present, the writer doubts

that such change to bulk handling will in fact admit of export as cheaply as the present efficiently organized hand labor now affords the Argentine export trade.

**Trade Relations**: The interest of the people in the United States and those of the citizens of Argentina have many points in common with regard to the flax crop. With us, such interest rests primarily in the propositions of saving an important crop in farm economy and in insuring a proper supply of seed to carry on the manufacturing industries of this country. The crop, as at present grown in the United States, is chiefly located in comparatively limited areas in four Northwestern states, under soil and climatic conditions which admit of no large expansion and allow but slight opportunity to vary seed time or harvest to meet seasonal vicissitudes. The supply of seed as coming from Canada is also chiefly grown in territory immediately adjacent. Thus, drought, hot winds, frost, and other detrimental factors, when occurring, commonly influence the entire North American crop.

In normal years there may be almost enough seed produced in the United States and Canada to supply the manufacturing industries, and the needs of this country for consumption of the various manufactured products. In years in which the crop destroying factors have greatly limited production, it is a matter of much importance to all of our people that paint manufacturers, linoleum and other in-

Loading ocean-going steamer at Diamante with flax direct from large warerooms on River Parana, southern Entre Rios.

dustries may be able to procure sufficient flaxseed to carry on the industries and furnish manufactured supplies for local consumption at a rate not too expensive to the purchasing public. It is not simply

a matter of so much linseed oil or of sufficient linseed cake for stock feed, but affects all lines of manufacturing and construction from simple electrical supplies and toys to finest furniture, heavy farm machinery, automobiles, trucks, railway cars, supplies, metal construction, etc. As all such manufacturing involves the use of linseed in one phase or another of construction, it is readily seen that, this, at first thought, comparatively small unimportant crop is of great national importance, employing thru these industries much skilled labor and greatly affecting commerce, exportation and trade.

*Argentina is the natural source for such additional supplies of flaxseed as may be needed.* It would, therefore, seem to be quite as important to the farmers and business public of Argentina that the extensive industries, paint manufacturing, and linseed crushing in the United States run along under normal conditions of production and sales relations as it is to the flaxseed producers of Northwestern United States. It should be apparent to citizens of Argentina that numerous supplies which come to them from the United States, heavy machinery, farm machinery, automobiles, linoleum, furniture, leather goods, and a wide range of miscellaneous household supplies can hardly be prepared without high quality linseed oil; and, until Argentina is prepared to make these important products locally, she is interested that trade relations be so adjusted that her people may receive them at least possible cost. It is also apparent that mass production by such in-

This ocean-going river steamer is being loaded direct from warerooms at Santa Fé. Covered sheds over conveyor belts at this port admit of loading regardless of rain.

dustries cannot occur or prosper in any country unless the raw foundation products for manufactories are largely available and the manufactured products chiefly used by its own people. *This, then, con-*

*stitutes a just basis for careful consideration of cropping conditions, methods and trade relations between the two countries.*

Since Argentina began to produce flax the United States has been a liberal buyer of flaxseed from that country; and as we have not in most years produced sufficient seed to supply our manufacturing purposes, it is but natural to suggest that great care be taken to see that trade relations, in the broadest sense, be properly adjusted with this natural field of trade. The Argentine republic is, at present, the largest producer of linseed (flaxseed) in the world.

While the Northwestern states produced something over 20 million bushels of flaxseed during the crop year of 1930, nevertheless, they have but three times in history equalled or exceeded that amount. Extended studies of conditions of flax cropping in the Northwest associated with worldwide observations, particularly in Russia and in Argentina, convince me that the flax crop in the United States in the near future will need such protection as can reasonably be given thru national tariff and proper trade relations more badly than ever needed before. This is perhaps more true for this crop than for any other major crop. It is quite apparent that our farmers working upon the small areas to which they are individually confined need our national market to the fullest extent that may reasonably be given; for they are now coming into what appears to be rather permanent competition with large areas of land elsewhere controlled by comparatively few but able managers.

Working on individual, small areas and under intensive conditions, the farmers of the states will be under plenty of handicap without opening the home markets to those countries which have large areas of native soil unturned or extensive areas of old lands of fine quality yet open to mass farming. As indicated, it seems that flaxseed produc-

*Negative by Dr. C. A. Bahre, Buenos Aires*

Typical home of northern Argentine natives. These families furnish a large part of the itinerant labor of Argentina.

tion in the United States must of necessity remain on the present plan of small farm areas intensively done. There are no great areas of new or virgin lands in our present flax farming areas and *cropping becomes*

*almost wholly an old land proposition.* This means careful selection of lands; indeed, such as if farmed at considerable cost will rather certainly produce reasonable yields per acre. It means expensive preparatory tillage for control of weeds, and the breeding selection and retention of true varieties, resistant to various destructive diseases of such types as shall admit of production under our climatic conditions. It must be remembered that even disease resistant varieties—those which are highly resistant to root diseases cannot be handled with success upon the old lands under the careless methods that have previously been used upon the new lands. Thus, each year, the expense for keeping up increased production per acre must of necessity increase per farm rather than decrease.

Argentina actually produces an enormous small grain and meat crop for export and accomplishes such production and exportation with a comparatively small total population. Indeed, the work seems to be done by a limited number of reasonably permanent farm laborers and itinerant natives. The total population of the nation may be placed at approximately 11 millions and it is quite probable that less than 4 million of these actually live under rural conditions or in rural communities. Exclusive of women and children, it is apparent that the work of this enormous crop production and crop exportation is accomplished by a labor population not greatly exceeding 1½ million men. This comparatively small number of rural people not only handle the great cattle and sheep industry of the country but also the large masses of grains produced for export. At the present time approximately one-half of the world export in flaxseed moves out of the ports of eastern Argentina. It is evident that this rural labor population of Argentina does not govern or largely affect the cost of flaxseed exportation by Argentina.

A manager's home on one of the large grain areas in the Province of La-Pampa.

It is quite apparent that the farm and labor population are not able or, at least, do not make use of any large amount of funds in the production of homes on the land. Even if the question of the comparative scale and cost of living were not involved in the comparative cost of flaxseed production there and in the United States, nevertheless, it is apparent that so few people are actually involved in the

production and exportation of this Argentine crop that the returns to those engaged may be such that the comparative costs of living there and in the United States may have little to do as to whether a lower price on the world market for flaxseed may or may not be readily met by Argentina. Even tho the per diem of rural labor in that country were reasonably equivalent to that of those producing and handling the crop in this country, it would not of necessity indicate a fair basis of comparative costs and sacrifices; for aside from the large estates owned and operated under mass farming conditions, there is no apparent home life which at all compares to the rural life of individual farmers who produce the crop in the United States.

Typical grain handlers at wareroom in Southwest La Pampa Province.

Better home life conditions on the farm, is one of the developments which may soon take place in Argentina upon the incoming of European immigrants and the actual establishment of homes upon large areas of government lands or upon the future breaking up of many of the large ranches. Many of these colonists now appear to be operating in a very effective manner in the production of a large bushelage of small grains. However, whether one speaks of European colonists or the native labor, the fact remains that home life on the farms is not now on a plane equivalent to that of farm population in the United States. The problem involved in determining whether our farmers can or cannot compete with Argentine production in flaxseed then, *depends more definitely than one might at first think upon the question as to how cheaply Argentine grain merchants can actually market the product that comes to them.*

While Argentine methods of grain handling may yet be greatly facilitated by changes in process, it is doubtful if an equal number of freight handlers in the United States even with our machinery

could accomplish the handling of our flaxseed, as now grown, more efficiently or at less cost than now done in Argentina. This may be partly explained because of the condensed zones of production there,

Type of grain handlers to be seen at Diamante, Santa Fé, or Rosario. Man on the right is of the foreman type.

while our production is widely scattered in small lots on many farms. Again, with local Argentine freight handlers and wareroom laborers, whether foreign-born or native, the homes and standards of life at the local shipping points can hardly be rated as on a plane reasonably equivalent to that of our freight handling population.

So far as the farmers of the United States are concerned, success for them in the future must therefore rest in intensive production of higher quantity and quality on essentially the areas now under cropping. They are, therefore, quite right in demanding such proper trade relations as will permit them to do a better grade of farming on their highest grade of lands.

There are questions as to methods in agriculture and commerce which are of mutual importance to the people of the two countries. *An unreasonable production in either one of these countries or in the two combined must inevitably result in prices for the raw products quite destructive to the farming and business public of each.* As an observer upon methods I have noted the tendency in each country to aim at increased acreages under culture rather than quality production. *In this country, it must be recognized that in years of large production, much of the linseed which is marketed is produced upon marginal lands of poor quality and at a cost which does not properly pay for the investment and labor expended.* This can, of course, readily occur also under Argentine conditions; for, aside from the

extended areas of new land of high quality heretofore mentioned in which flax cropping may be expanded, there are undoubtedly large areas of similar marginal lands in Argentina yet in native sod which when broken may under certain years of *best* climatic conditions produce large crops. As these new areas are introduced to cultivation by way of railroad expansion and the incoming of colonists, there will undoubtedly be a great extension of flaxseed culture, not only upon the high quality new lands available but upon such marginal lands as indicated.

To date, it is obvious that flaxseed production has been held largely upon the heaviest most productive soils of Argentina. The crop has been grown in very close relation to the most important crop, corn, or upon newly worked sod and alfalfa pasture lands and there is yet great possibilities of expansion. *It is important, therefore, that our people dealing with the question of trade relations have well in mind* the rather great possibilities yet open to the Argentine agriculturists for the production of flaxseed, and that we in our own efforts at production take note of methods and processes which have most success.

# Argentine Flaxseed Samples Under Test at North Dakota Agricultural College and Experiment Station

Aside from general agricultural observations as outlined, a primary purpose of this survey was to procure flaxseed samples or seed from individual plants suitable for trial, selection and development for seed production under our Northwest conditions. Careful study

In selecting samples for our future plant breeding work, effort was made to procure samples from defintely known farms, areas or zones. Our helper and interpreter, Mr. Luplau, is here procuring a sample from an individual bag from a definite farm in western Entre Rios, north and east from the city of Diamante.

was placed upon numerous Argentine fields of standing and harvested flax for the purpose of making individual selections of plants and special samples of seed for such continuation studies. In all, 409 separate selections of seed were made in varying amounts from seeds of individual plants to several pound samples from farm, farm wagons, and warerooms. Selected ounce samples were early forwarded by parcel post to insure trials upon flax-sick soil under greenhouse conditions and to insure early planting upon the *flax garden where tests are made to bring about survival of plants of fittest ability to resist diseases.*

On returning in early May the remaining samples were brought with us and arrangements were immediately made to continue the planting so that each sample of seed would at least be brought under test the first year upon soils of type known to be essentially free from wilt and root diseases and also upon the intensively infected soils of the so-called "Inoculation garden" (*Pathologium.*)

View of a part of the Argentine samples as planted in greenhouse in March of 1931. Notice that there are varying strengths and heights of growths exhibited by the different samples.

Regardless of the trying conditions of the summer and the speed necessary to prepare and treat the seed during an unusually short planting season, the work so far as results go, even under conditions of intense drought and heat, give promise that we shall at least procure a number of individual types of large-seeded flax; indeed, of all of the various types seen in Argentina, taken as survivals upon wilt-sick soil; and seed in larger quantities was successfully produced upon soil of less disease infection.

Careful notes are taken upon the germination records as made in the wilt-sick soil and characteristics of growth thruout the season and at harvest. Photographs have been made at various times for record of the first year results. All of the plants of each sample have been saved for record of quantity produced, quality and type of seed, resistance to wilt, other root diseases, rust and *Pasmo,* and upon height and strength of growth, etc.

Steps have been taken to proceed with the usual line of investigation by which we have in the Department of Botany and Plant Pathology of the North Dakota Experiment Station previously developed the so-called resistant varieties of flax. Each selection, variety and type of seed procured will be provided opportunity to prove its merits

under the trying conditions, *developed particularly for the elimination of the weak and the preservation of the strong and sturdy.* Whether of short or long straw, large or small seed is not, at present, the primary consideration. The problem is the more scientific consideration as to which type or individual pure line strain is most sturdy for our hard, harsh, short seasonal cropping conditions.

Mr. Carl Oveson, student aid, is shown counting out 200 seeds from each sample preparatory to planting upon flax-sick soil on the North Dakota Agricultural College flax garden.

It is safe to say that the trials in the grounds here at the college excelled all previous years I have ever experienced for the destructive effect of drought and heat. It is possible that even such seasonal factors may serve us well in the final selection of the type of seed which may later be developed or increased for further trial and experimental tests, and possibly may furnish the bases for proper cross-breeding that may give us the type of large-seeded flax of high yield and oil quality needed.

Some correspondence and conversation with our farmers convince me that many people have not well understood the purpose of these investigations. There was no hope or intent of bringing back large bulks of seed which might immediately be placed in distribution on northwestern farms.

As previously indicated, it was thought that such bulk lots of seed as might be procured in Argentine cropping districts would quite likely give results similar to those which Argentine samples have been giving in this country for a number of years. At this point, *it may be wise to suggest to those who hope to improve present flax cropping methods that because certain varieties grow upon straw too short to overcome great growths of weeds should not be held as a demerit to the possible productive value.*

A view of a portion of the Argentine samples surviving on the flax-sick soil of Plot 30, North Dakota Agricultural College, August 30, 1931. Notice that certain samples are much more resistant than others, and that many have died out under the hard, harsh conditions due to wilt and drought. Seed from best selects of these are already growing in the greenhouse, for cross-breeding work, the third planting from Argentine select samples.

I saw enough in the better flax growing zones of Argentina to convince me that our farmers expect too much of this crop. For years they have been in the habit of sowing such bushels of seed as they chance to have into soil of whatever type they happened to have available and have expected it to be able to respond upon a seed-bed permeated with countless masses of weed seeds from previously improperly handled weedy crops. I have indicated in bulletins previously written and in this one that corn is a proper crop to immediately precede flax. It should, of course, not be understood to mean that a piece of land that has produced more weeds than corn is a proper place upon which to prepare a seed bed. The merits of the corn crop in producing a seed bed for flax rests in proper cultivation of the corn and the splendid opportunity it gives to free the lands from immense growths of weeds. Suffice it to say that the corn crop, as here cultivated, often tends to fill the soil with the seeds of destructive coarse-growing weeds. Farmers in preparing a seed bed for flax of whatever variety used

must of necessity understand that it is not a type of crop, whether of short straw or tall straw, which can satisfactorily compete with weeds. All will, I think, agree that, if a crop of good seed bolls can be produced upon straw from 14 to 18 inches high, we now have harvesting machinery which will save the seed so produced. The use of combines and headers may materially change the viewpoint as to the necessity of growing tall varieties. If flax fiber is needed it is a more sensible proposition to produce the fiber in fiber varieties in regions suited to fiber straw production.

# Weight of Seed, Quantity and Quality of Oil in Argentine Flaxseed

It is a common assertion of linseed oil producers that large-seeded flax varieties have many merits for them in their work, resulting in ease of elimination of seed of other types, seed cleaning before crushing, etc. It is also apparently a common belief that Argentine varieties of flaxseed as received in the United States are of higher moisture content and somewhat lower oil quality than that of the average northwestern-grown flaxseed. Analyses as published in Argentina,* representing some tests made in the year 1929-30 upon certain samples from different districts and upon various pure line selections grown during the crop of 1929-30 tend in a limited manner to confirm these ideas.

It is an observation of the writer that apparent high quality seed as called of first quality in commercial market depends more largely upon soil and climatic conditions during normal growth period, ripening and harvest than upon variety. Early tests extending over a wide range of North Dakota soils tended to show that small-seeded types as to oil quality and quantity were of quite as high oil content and type as those of the larger-seeded varieties. Later chemical tests made upon pure line crops now seem to show that a higher quality and quantity of oil content may be produced than is characteristic of best quality commercial bulk seed which, at best, usually represents mixtures of various production types and strains.

This selection of a wide range of samples from the Argentine crop year of 1930-31 naturally affords opportunity to gain further data on this matter. Immediately upon arrival here, sufficient seed from 212 samples of the Argentine collections were placed with Professor T. H. Hopper, Agricultural Chemist of the North Dakota Experiment Station for test of content and quality of oil produced.

While certain of these samples both as farm lots and as commercial lots contain a variable amount of scabbed or scaly seeds "*manchada*" records are so made that it is known which samples are unaffected and which have a varying percentage of scab seed, place of growth, etc.

In North Dakota, scabbing or scaly type of seed comes about because of a wide range and varying type of injury. Often it is due to some factor which blights the stems, roots, and bolls at a time when not fully mature. A proper consideration of such features must eventually involve analyses of those types of injury known to be due to specific causes, for example, wilt and root destroying fungi, rust and *pasmo*, to frost or water, at or following harvest. Naturally varieties highly resistant to the various types of disease, in part, tend to eliminate the scabbing and scale due to such disease.

*Almanaque del Ministerio de Agricultura, 1931, pp. 328-329.

Argentine grain handlers usually attribute dark-colored, scabby seed chiefly to deterioration of the seed thru moisture effects during harvesting, threshing, and storage periods. It is doubtful if such moisture injuries as only affect the color materially interfere with the oil content and possibly even the quality. Such questions yet remain for continued chemical investigation upon types of known origin and of known kind and grade of injury. The purpose of analyses as herein reported by Professor T. H. Hopper are given to show what, if any, variations may be noted in the different samples as selected by the writer from a wide range of Argentine districts and farms for the harvest of 1930-1931. The following statement and data as given in the tables and graphs have been prepared by Professor Hopper for report at this time.

## Chemical Analyses of Argentine Flaxseed

T. H. Hopper

Of the samples collected in Argentina, 212 were furnished the Department of Agricultural Chemistry for analyses. These samples were analyzed for the percentage of oil which is calculated and reported on the dry basis; and the Iodine number, according to the Wijs method, was determined on the oils expressed from these samples with an hydraulic press. In addition to these determinations, the weight of a thousand seeds of each sample was determined. The results of the examinations are given in the table below.

Inspection of this table shows that the oil content, calculated on the dry basis, varied from 34.3 to 41.28 with an average of 38.12. If the oil content were calculated on a basis in which the flax contains 6 percent moisture, the average oil content would be 35.83. The Iodine numbers vary from 170 to 198, giving an average of 182. This value is five points above the minimum specification, 177, as given by the American Society of Testing Materials.

Analyses of Argentine Grown Flaxseed
1930-1931 Crop Season

| Laboratory Number | Bolley's Serial Number | Total Oil Content (Dry Basis) % | Iodine Number (Wijs) | Weight of 1000 Seeds Grams |
|---|---|---|---|---|
| 31-8-111 | 19 | 40.06 | 179 | 5.4478 |
| 112 | 20 | 36.74 | 180 | 5.4069 |
| 113 | 21 | 40.17 | 179 | 5.3665 |
| 114 | 25 | 38.00 | 183 | 6.2680 |
| 115 | 26 | 40.68 | 185 | 6.0158 |
| 116 | 27 | 38.44 | 181 | 6.4417 |
| 117 | 28 | 39.39 | 186 | 5.8700 |
| 118 | 29 | 38.89 | 182 | 5.7473 |
| 119 | 30 | 39.86 | 183 | 5.9460 |
| 120 | 34 | 40.20 | 182 | 5.8921 |
| 121 | 36 | 38.09 | 184 | 6.8530 |
| 122 | 39 | 40.29 | 183 | 6.3910 |

| Laboratory Number | Bolley's Serial Number | Total Oil Content (Dry Basis) % | Iodine Number (Wijs) | Weight of 1000 Seeds Grams |
|---|---|---|---|---|
| 123 | 43 | 40.13 | 183 | 6.6105 |
| 124 | 37 | 40.83 | 183 | 6.4795 |
| 125 | 44 | 38.90 | 186 | 6.8333 |
| 127 | 46 | 38.58 | 185 | 6.9354 |
| 128 | 47 | 39.06 | 186 | 6.5877 |
| 129 | 48 | 38.78 | 186 | 7.1764 |
| 130 | 49 | 38.64 | 173 | 6.2949 |
| 131 | 50 | 38.12 | 174 | 5.4277 |
| 132 | 51 | 38.53 | 183 | 6.8170 |
| 133 | 52 | 38.95 | 186 | 6.9165 |
| 134 | 53 | 37.30 | 177 | 6.5628 |
| 135 | 54 | 36.88 | 178 | 6.5923 |
| 136 | 55 | 38.86 | 179 | 6.7853 |
| 137 | 56 | 38.23 | 187 | 7.2967 |
| 138 | 56½ | 38.21 | 180 | 6.8243 |
| 139 | 57 | 39.62 | 183 | 5.9059 |
| 140 | 58 | 38.30 | 188 | 7.4756 |
| 141 | 59 | 38.65 | 186 | 7.0168 |
| 142 | 60 | 38.74 | 185 | 7.2055 |
| 143 | 61 | 39.82 | 182 | 6.2620 |
| 144 | 62 | 39.81 | 184 | 6.4449 |
| 145 | 63 | 38.71 | 187 | 6.7022 |
| 146 | 64 | 39.12 | 186 | 7.1697 |
| 147 | 67 | 38.04 | 180 | 6.3329 |
| 148 | 68 | 37.25 | 178 | 6.1291 |
| 149 | 75 | 36.41 | 176 | 5.5668 |
| 150 | 77 | 38.51 | 187 | 7.4540 |
| 151 | 78 | 36.72 | 181 | 7.0018 |
| 152 | 79 | 38.02 | 176 | 6.5424 |
| 153 | 80 | 36.87 | 177 | 6.9486 |
| 154 | 81 | 39.14 | 175 | 5.6962 |
| 155 | 82 | 38.06 | 177 | 6.5713 |
| 156 | 83 | 38.14 | 178 | 6.5900 |
| 157 | 84 | 38.09 | 176 | 6.4390 |
| 158 | 85 | 37.72 | 170 | 6.0465 |
| 159 | 87 | 36.85 | 178 | 6.7110 |
| 160 | 89 | 39.28 | 180 | 6.8122 |
| 161 | 90 | 37.59 | 179 | 6.3096 |
| 162 | 91 | 38.92 | 181 | 6.7295 |
| 163 | 92 | 38.30 | 181 | 6.6430 |
| 164 | 93 | 36.79 | 180 | 6.8653 |
| 165 | 94 | 37.37 | 180 | 6.5424 |
| 166 | 95 | 36.65 | 179 | 6.8380 |
| 167 | 96 | 37.25 | 180 | 6.4444 |
| 168 | 97 | 38.06 | 180 | 6.3085 |
| 169 | 98 | 36.13 | 176 | 6.5831 |
| 170 | 99 | 37.07 | 177 | 6.6517 |
| 171 | 106 | 39.58 | 180 | 6.0796 |
| 172 | 107 | 39.33 | 181 | 5.8496 |
| 173 | 108 | 38.27 | 180 | 5.9728 |
| 174 | 109 | 39.08 | 182 | 6.2000 |
| 175 | 110 | 39.73 | 180 | 5.9452 |
| 176 | 111 | 37.38 | 180 | 6.2345 |
| 177 | 112 | 39.00 | 183 | 5.8709 |
| 178 | 113 | 38.32 | 185 | 6.2924 |
| 179 | 114 | 39.37 | 182 | 6.4333 |
| 180 | 115 | 38.42 | 182 | 6.2996 |
| 181 | 117 | 37.17 | 181 | 5.9057 |

| Laboratory Number | Bolley's Serial Number | Total Oil Content (Dry Basis) % | Iodine Number (Wijs) | Weight of 1000 Seeds Grams |
|---|---|---|---|---|
| 182 | 120 | 38.20 | 181 | 6.6300 |
| 183 | 127 | 39.37 | 180 | 6.3598 |
| 184 | 128 | 37.16 | 178 | 6.4335 |
| 185 | 130 | 35.17 | 176 | 6.1812 |
| 186 | 142 | 37.71 | 181 | 6.0893 |
| 187 | 143 | 36.87 | 179 | 6.6196 |
| 188 | 144 | 37.56 | 183 | 6.5400 |
| 189 | 145 | 37.73 | 183 | 6.6389 |
| 190 | 147 | 38.55 | 184 | 6.8662 |
| 191 | 148 | 37.64 | 181 | 6.3108 |
| 192 | 149 | 36.15 | 178 | 6.5964 |
| 193 | 150 | 38.42 | 183 | 6.5657 |
| 194 | 151 | 36.33 | 179 | 6.3152 |
| 195 | 152 | 37.55 | 174 | 5.8832 |
| 196 | 155 | 36.66 | 186 | 6.9542 |
| 197 | 160 | 38.89 | 189 | 6.1868 |
| 198 | 163 | 38.68 | 191 | 7.3307 |
| 199 | 168 | 37.99 | 179 | 5.9880 |
| 200 | 169 | 37.94 | 187 | 7.2606 |
| 201 | 170 | 38.81 | 184 | 6.1643 |
| 202 | 172 | 38.29 | 188 | 6.8896 |
| 203 | 173 | 39.47 | 184 | 5.7577 |
| 204 | 174 | 38.61 | 181 | 5.9378 |
| 205 | 175 | 37.69 | 183 | 5.9690 |
| 206 | 176A | 39.57 | 185 | 5.9762 |
| 207 | 176B | 39.17 | 185 | 5.7770 |
| 208 | 177 | 39.84 | 188 | 6.1822 |
| 209 | 194 | 37.22 | 183 | 5.9479 |
| 210 | 201 | 37.96 | 181 | 5.1677 |
| 211 | 202 | 38.38 | 180 | 6.7619 |
| 212 | 203 | 39.06 | 183 | 6.0800 |
| 213 | 204 | 37.76 | 181 | 6.7100 |
| 214 | 205 | 35.56 | 186 | 6.8100 |
| 215 | 206 | 36.05 | 182 | 6.5534 |
| 216 | 207 | 37.48 | 179 | 6.6221 |
| 217 | 208 | 38.04 | 181 | 6.6885 |
| 218 | 210 | 35.54 | 181 | 6.2336 |
| 219 | 211 | 36.08 | 181 | 6.7566 |
| 220 | 215 | 36.13 | 177 | 6.1022 |
| 221 | 226 | 38.68 | 191 | 7.0060 |
| 222 | 228 | 38.46 | 190 | 6.9679 |
| 223 | 229 | 39.07 | 189 | 7.1805 |
| 224 | 230 | 37.91 | 185 | 7.0637 |
| 225 | 231 | 36.77 | 184 | 6.6300 |
| 226 | 233 | 38.11 | 184 | 7.1577 |
| 227 | 234 | 39.05 | 186 | 6.5538 |
| 228 | 236 | 38.30 | 184 | 6.4475 |
| 229 | 239 | 36.85 | 180 | 5.5163 |
| 230 | 240 | 38.98 | 187 | 6.8310 |
| 231 | 241 | 38.94 | 180 | 5.5846 |
| 232 | 242 | 36.54 | 177 | 5.1095 |
| 233 | 243 | 37.88 | 178 | 5.3730 |
| 234 | 244 | 38.27 | 178 | 5.9522 |
| 235 | 245 | 39.51 | 187 | 6.4685 |
| 236 | 246 | 37.35 | 188 | 6.9732 |
| 237 | 248 | 37.07 | 184 | 6.7332 |
| 238 | 250 | 37.31 | 183 | 6.1144 |
| 239 | 251 | 37.79 | 182 | 5.4552 |

| Laboratory Number | Bolley's Serial Number | Total Oil Content (Dry Basis) % | Iodine Number (Wijs) | Weight of 1000 Seeds Grams |
|---|---|---|---|---|
| 240 | 252 | 39.59 | 188 | 6.7693 |
| 241 | 255 | 35.55 | 180 | 5.2731 |
| 242 | 256 | 38.37 | 186 | 6.3300 |
| 243 | 257A | 37.98 | 184 | 5.0785 |
| 244 | 257B | 36.87 | 182 | 5.5682 |
| 245 | 258 | 36.33 | 183 | 5.8941 |
| 246 | 259 | 38.57 | 184 | 5.4212 |
| 247 | 262 | 37.69 | 182 | 4.7464 |
| 248 | 271 | 37.18 | 190 | 6.6343 |
| 249 | 272 | 37.26 | 187 | 6.7400 |
| 250 | 273 | 35.67 | 189 | 6.1388 |
| 251 | 277 | 37.87 | 189 | 6.0674 |
| 252 | 278 | 37.27 | 187 | 6.8738 |
| 253 | 291 | 38.66 | 181 | 6.6914 |
| 254 | 294 | 40.65 | 181 | 5.5183 |
| 255 | 295 | 37.52 | 183 | 6.4552 |
| 256 | 296 | 39.35 | 190 | 6.5370 |
| 257 | 297 | 37.22 | 178 | 6.4630 |
| 258 | 298 | 37.59 | 178 | 6.1969 |
| 259 | 302 | 37.85 | 176 | 5.4500 |
| 260 | 304 | 36.92 | 177 | 6.2342 |
| 261 | 305 | 37.52 | 179 | 5.7778 |
| 262 | 306 | 40.39 | 177 | 5.6800 |
| 263 | 343 | 37.98 | 186 | 6.3118 |
| 264 | 344 | 37.61 | 185 | 6.1751 |
| 265 | 345 | 36.19 | 180 | 5.7613 |
| 266 | 346 | 39.79 | 183 | 5.5400 |
| 267 | 347 | 39.35 | 178 | 5.8068 |
| 268 | 348 | 37.70 | 184 | 5.7123 |
| 269 | 349 | 37.77 | 182 | 5.7533 |
| 270 | 350 | 38.50 | 184 | 6.6613 |
| 271 | 351 | 38.58 | 184 | 6.1947 |
| 272 | 352 | 38.78 | 182 | 6.1785 |
| 273 | 353 | 38.40 | 182 | 5.8600 |
| 274 | 354 | 38.04 | 185 | 6.2034 |
| 275 | 355 | 37.48 | 184 | 6.0800 |
| 276 | 356 | 38.94 | 187 | 6.0322 |
| 277 | 357 | 39.26 | 181 | 5.4489 |
| 278 | 358 | 37.43 | 178 | 5.9337 |
| 279 | 359 | 38.84 | 180 | 6.4428 |
| 280 | 360 | 36.55 | 177 | 6.1111 |
| 281 | 361 | 38.69 | 180 | 6.0688 |
| 282 | 362 | 38.50 | 186 | 5.4598 |
| 283 | 367 | 38.98 | 188 | 5.9080 |
| 284 | 368 | 39.48 | 184 | 5.9418 |
| 285 | 372 | 39.30 | 186 | 6.9549 |
| 286 | 373 | 38.73 | 180 | 6.5969 |
| 287 | 374 | 39.15 | 176 | 5.8626 |
| 288 | 375 | 38.54 | 180 | 6.8721 |
| 289 | 376 | 38.13 | 183 | 6.6147 |
| 290 | 377 | 36.25 | 177 | 5.5477 |
| 291 | 378 | 38.86 | 184 | 7.0487 |
| 292 | 379 | 37.51 | 178 | 6.9472 |
| 293 | 380 | 38.73 | 178 | 6.2937 |
| 294 | 381 | 37.73 | 182 | 6.7943 |
| 295 | 382 | 36.37 | 182 | 6.6590 |
| 296 | 384 | 37.52 | 180 | 6.8354 |
| 297 | 385 | 38.18 | 180 | 6.8220 |

| Laboratory Number | Bolley's Serial Number | Total Oil Content (Dry Basis) % | Iodine Number (Wijs) | Weight of 1000 Seeds Grams |
|---|---|---|---|---|
| 298 | 386 | 37.56 | 184 | 6.8613 |
| 299 | 387 | 37.15 | 178 | 6.4339 |
| 300 | 388 | 38.79 | 185 | 6.8125 |
| 301 | 389 | 39.77 | 188 | 7.1308 |
| 302 | 390 | 37.87 | 179 | 5.4178 |
| 303 | 391 | 39.52 | 198 | 5.1659 |
| 304 | 392 | 36.47 | 180 | 5.9968 |
| 305 | 393 | 36.26 | 174 | 4.5807 |
| 306 | 394 | 34.30 | 175 | 4.8421 |
| 307 | 395 | 38.51 | 179 | 4.8241 |
| 308 | 396 | 35.78 | 181 | 5.5306 |
| 309 | 397 | 36.34 | 179 | 5.2536 |
| 310 | 398 | 38.09 | 179 | 5.3315 |
| 311 | 399 | 38.38 | 181 | 5.0072 |
| 312 | 400 | 38.45 | 178 | 4.8803 |
| 313 | 402 | 34.61 | 180 | 5.6300 |
| 314 | 403 | 39.35 | 187 | 6.8700 |
| 315 | 404 | 41.28 | 186 | 6.2876 |
| 316 | 405 | 35.43 | 172 | 3.9673 |
| 317 | 406 | 36.50 | 179 | 4.3562 |
| 318 | 407 | 37.56 | 172 | 4.1562 |
| 319 | 408 | 35.94 | 177 | 6.0600 |
| 320 | 409 | 34.85 | 180 | 5.2407 |
| 328 | 264 | 37.50 | 179 | 4.9084 |
| 329 | 269 | 37.66 | 184 | 6.4527 |
| Highest | | 41.28 | 198 | 7.4756 |
| Lowest | | 34.30 | 170 | 3.9673 |
| Average | | 38.12 | 182 | 6.2270 |

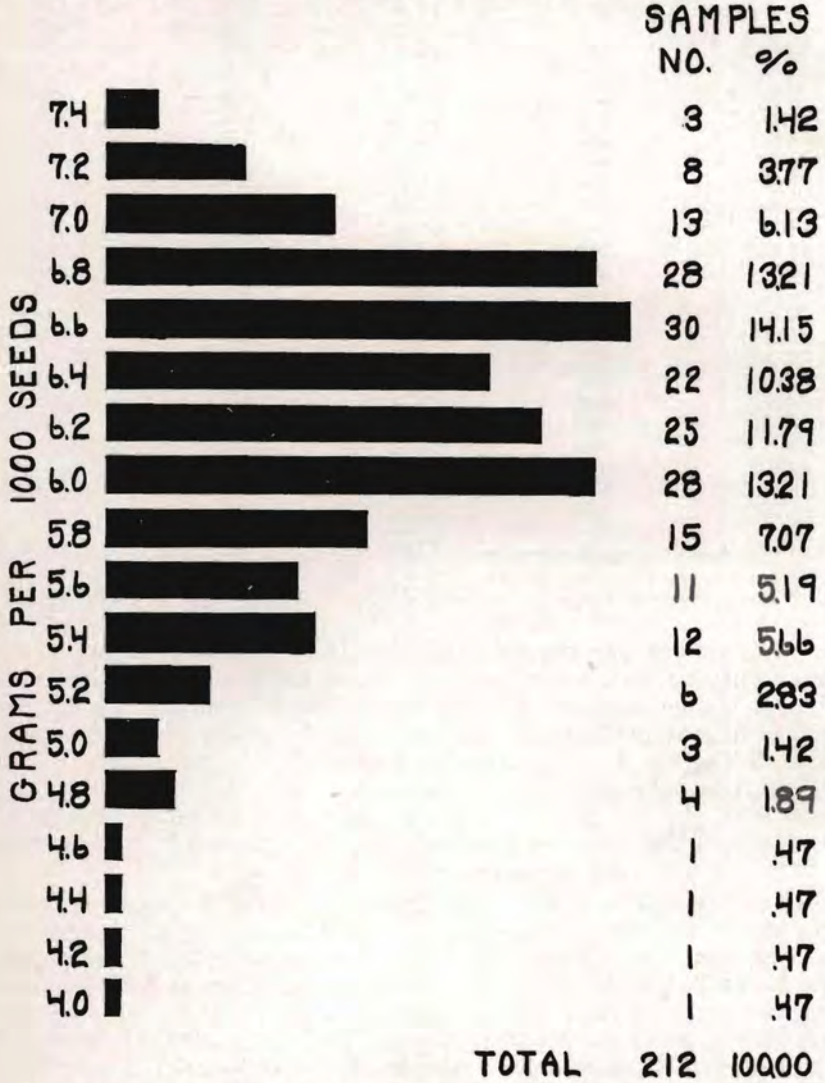
The weight per thousand seeds varied from 3.97 grams to 7.48 grams, having an average of 6.23. It is evident that in percent of oil and Iodine number of oil that the South American flax is very similar to that produced in the American Northwest, but with respect to seed size, the South American seeds are somewhat larger. These observations may be somewhat different than those generally made because of the fact that the samples collected were taken from rather good lots of flax and the group did not contain many samples much injured by water or otherwise.

The samples were all taken from the 1930-1931 cropping season, and tho they were collected over a comparatively large territory, (see map on cover page), on account of the latitude of the country and general climatic zone it is thought that the extreme variations of the climatic conditions of one season to another would not be represented in a group of samples collected during one season. It may be that the samples as collected and examined were those of a more favorable season than the average.

We have found in the examination of North Dakota grown flax that the variety is a large factor in determining the quantity and quality of oil in the flaxseed, but even a larger variation is due to the climatic conditions of the growing season. The work under way, wherein samples over a number of years are being analyzed, should

give some indication as to what climatic factors will tend to produce high oil content and high Iodine numbers.

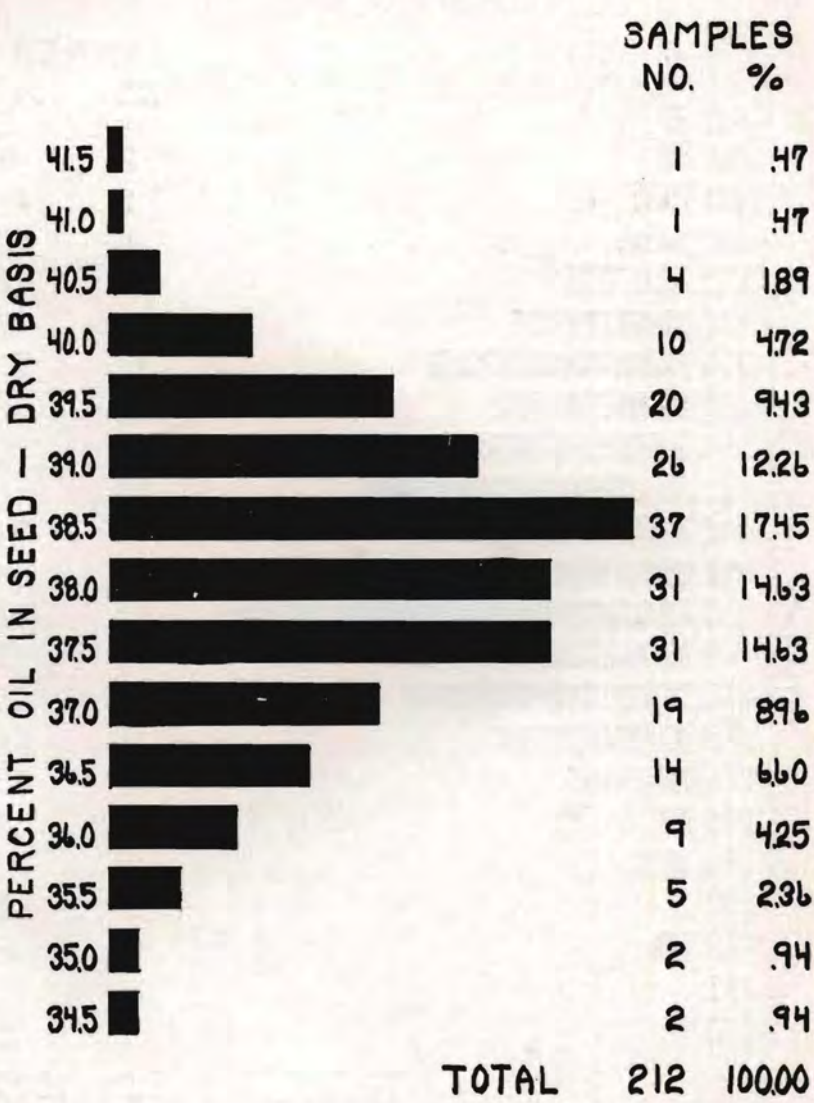
The distribution of the flax samples according to grams per thousand seeds, percent of oil in the seed and Iodine numbers of oil is shown graphically on pages 78, 79, and 80. An examination of




Distribution of flaxseed samples according to weight per 1,000 seeds.

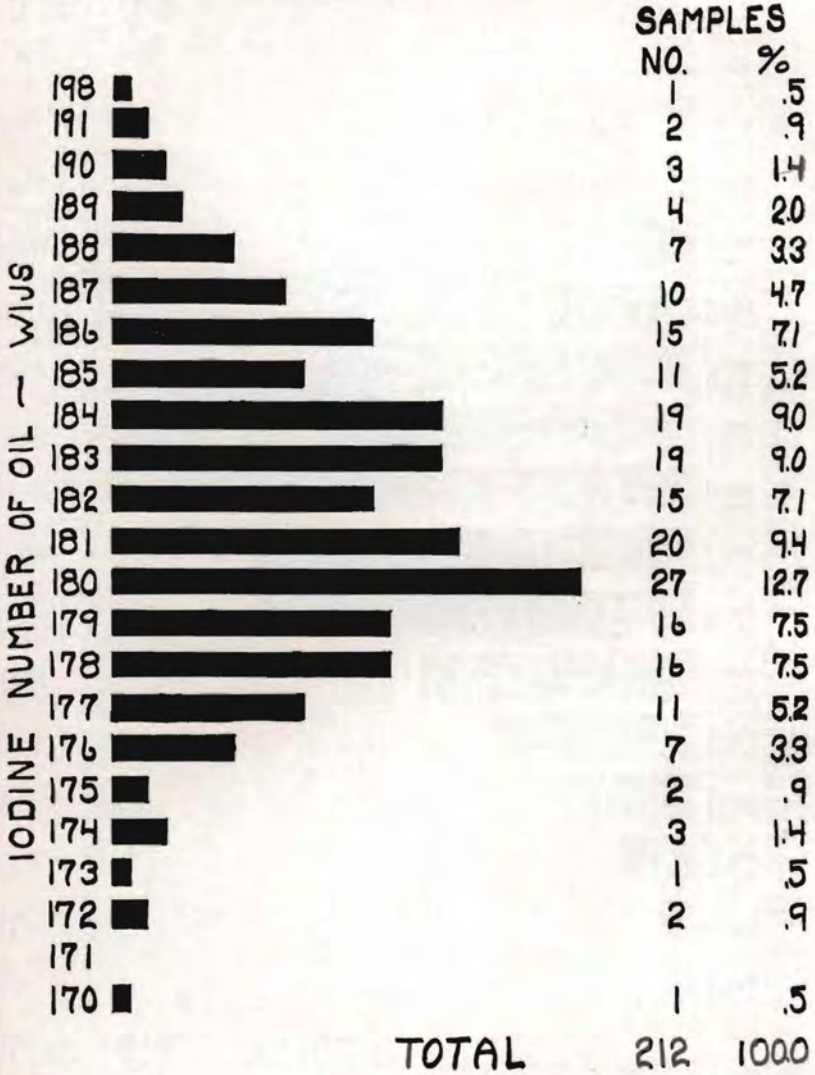
these charts shows in general the distribution of the samples, but the number of samples available were not enough to produce a normal distribution curve.

It is hoped the work may be continued to include the examination of the flaxseed grown in North Dakota from the Argentine seed.




Distribution of flaxseed samples according to percent of oil in seed on the dry basis.

Acknowledgement is here given of the assistance rendered by L. L. Nesbit, A. J. Pinckney, assistant chemists, and Miss Bernice Emmons, in the examination of the flax seed samples.




Distribution of flaxseed samples according to the iodine number.

Agricultural College, North Dakota,
November 28, 1931.

T. H. HOPPER

# Summary

No definite attempt was made to determine cost of production in flax or other crops. Crop statistics have not as yet been made on such complete or inclusive bases as would justify drawing reasonably accurate conclusions either as to exact yields or exact costs of producing such crops as flax, wheat, corn, and cattle. Present methods of gathering statistics there, as well as in our own country, are hardly adequate to determine exactly what such costs are; for the factors involved in yearly production and marketing are so erratic that statistics centered about a few individual farms in a few zones, districts, or check plots on yields at best form a doubtful measure of costs.

The writer is hopeful, however, that the main purposes of this survey have been fairly attained, namely: (1) To observe the conditions and methods of crop growth with a view to better aiding to an understanding of what must be done to properly raise the flax crop so that the yield per acre will most likely compensate growers; (2) to understand what are the legitimate relations of Argentine flax cropping to flaxseed production, marketing, industrial and rural life in the United States.

Such matters must be taken into consideration in any proper study of cost accounting and of trade relations. Cost accounting for production is not alone the proper basis for determining such matters in any country.

*Living conditions and advantages in the production of the crop, whether they show in cost per acre or not, are matters of vital consideration when thinking of improving a nation's agriculture and associated industries.* Argentina and other nations have many natural advantages for the production of flaxseed not usually taken into account when discussing trade adjustments.

In Argentina there are large areas of high quality land suitable to extension of the culture of cereals, small grains, flax, and the necessary cattle and forage crops to make such cropping a success. The primary industry of Argentina is the production of beef, dairy cattle, sheep, goats, and other animal products. This great animal industry associated with proper areas for extension and intensification insures heavy yields of cereals and small grains, including flaxseed which is one of their chief supporting crops for cash export.

At present, flaxseed production is intensified in a comparatively small area of the country and is closely affiliated with alfalfa, corn and other forage cropping and the great cattle and sheep industry. There are millions of acres of fertile and possibly productive lands into which these allied types of agriculture may be expanded, as the population increases. Argentine statistics since 1872 show a rather gradual, normal, and healthy expansion year by year.

The agricultural lands of Argentina are largely held in great estates. Aside from the great estates individual farmers are able to operate on a much larger acreage basis than now possible in the United States unless some systems of cooperative growing and marketing may yet be instituted.

It is evident from climatic conditions, temperatures, rainfall and from the areas of land available, that should world demand for flaxseed be found to justify greater production, the Argentine people can readily expand to double or even quadruple the acreage and bushelage now produced.

The agricultural lands of Argentina are closely contiguous to deep water river and ocean ports. *Comparatively slight railroad mileage is required to readily transport the grain from the farms to the ports of export as compared to the mileage required from northwestern United States to our points of manufacturing.*

While an enormous crop of cattle and other agricultural products are now handled for export by a relatively small population, modern machinery and storage for handling in bulk give promise that the Argentine output in the near future may be readily and greatly enhanced.

The incoming of new citizens, farm colonists, to Argentina from the farm-minded regions of Europe insure even greater advances in proper croppings of a wonderful expanse of productive lands.

Social, rural and business life is primarily different than in the United States. There is efficient hand and machine labor which, under the conditions, undoubtedly does and can labor at a much cheaper rate than the North American farmer and his labor associates can do under our system and living conditions. *Figures based on crop accounting alone can, thus, hardly determine a fair basis of competition.*

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## Future Investigations

The work of breeding and selection upon these samples of Argentine seed will be continued from year to year. It is also intended to study the oil content that may be developed in the increase crops that may follow.

# Acknowledgments

I wish, at this time, to express my appreciation to the Board of Administration of this Institution and to the Flax Development Association in making it possible to enter upon this line of studies.

I especially desire to extend sincere thanks to the Ministry of Agriculture of Argentina, particularly Director Isidro Pastor and his able staff of experiment station workers; the heads of the Argentine grain handling firms of Louis Dreyfus, Bunge and Born, and I. and E. Pillitz Company; various Argentine and other farm machinery companies, especially to the representatives of the International Harvester Company; members of the National City Bank, United States Chamber of Commerce, American and Canadian Consulates and Commercial Attaches; and to the managers and representatives of the Argentine railways, who kindly extended every possible courtesy to facilitate investigation and observation while there.

I wish to express my appreciation also of the kindness of Professor T. H. Hopper in undertaking the chemical tests and analyses herein reported, and to Mr. W. C. Palmer in aiding me in the preparation of the manuscript and proof sheets for this publication.

HENRY L. BOLLEY.

December 1st, 1931.
State College Station,
Fargo, North Dakota.

THE FINEST APPEARING FLAX SAMPLES THAT I PROCURED CAME FROM SCRUB TIMBER LANDS OF NORTH SANTA FE' AND THE CHACO. FLAXSEED IS ALREADY TRAVELING OVER THIS AND SIMILAR HIGHWAYS AT THE TIME OF THIS WRITING.