

THE PROBLEM OF RED CLOVER SEED PRODUCTION IN FINLAND

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The area of grassland on arable land in Finland covers about 1.4 million hectares, or 55 % of the cultivated land. The majority, 45 %, is grassland for hay and silage, 9 % is pasture and 1 % seed fields. Timothy and red clover are the most important grassland crops. Finland has natural possibilities for the production of timothy seed, chiefly on the peat soils of the province of Pohjanmaa lying between latitudes 62.5 and 65 in West Finland, and the production is so abundant that each year there remains a surplus for export. During the present decade Finland has exported 890 tons of timothy seeds annually.

The situation is quite different in regard to the production of Finnish red clover seed. There are great difficulties connected with this, and the seed yield varies considerably from year to year. About 300,000 hectares of grassland are established each year in Finland and the annual demand for red clover seed is about 2 million kilograms. According to official crop estimates, the production of red clover seed has exceeded 2 million kilograms in some years, but these figures are highly approximate. Red clover is the most important forage crop in Finland and therefore the meeting of the demand for red clover seed is one of the most urgent problems in the whole plant production of Finland.

Only the late flowering, single cut red clover gives a reliable crop in Finland. Therefore, when the importation of red clover seed has been necessary an effort has been made to import only such seed which according to research tests should prove valuable for cultivation. In the 1920's red clover seed was imported from Estonia and Sweden and in one year (1929) from the Soviet Union. During the period 1922—32 the yearly imports averaged 38.6 tons. In 1933 the importation of red clover seed could be temporarily discontinued owing to the more favorable conditions for seed production during the 1930's, and the import prohibition could be maintained up to 1940.

In 1940 a very unfavorable period for the seed production of red clover began in Finland, and it has lasted for 17 years. During this long period comprising the forties and fifties, Finland was self-supporting in respect of this seed in one production year only, namely 1950—51. In all the other years considerable quantities of red clover seed have been imported, especially during the present decade. On

an average 78.5 tons of red clover seed were annually imported in the years 1941—50. In 1952—57 the imports averaged 272.3 tons yearly. Finland's yearly red clover seed imports during the time of its national independence (since 1918) have been as follows:

<i>Year</i>	<i>Average per year, tons</i>
1922—32	38.6
1933—39	—
1941—50	78.5
1951	—
1952—57	272.3

During the five-year period 1952—56 the quantity of imported red clover seed was 2.7 times as large as the amount of domestically grown seed marketed in retail sale. I regret to say that the share of imported red clover seed has become of progressively increasing significance in fodder production in Finland.

In the forties — with the exception of the year 1948 — all the imported red clover seed originated from Sweden. Since the summer of 1947 was very unfavorable for seed cultivation, so that Sweden also had no late flowering red clover seed for export, Canadian red clover seed, variety »Altaswede», was imported into Finland for the first time in the spring of 1948. Later in the fifties Finland has had to continue the importation of Altaswede because Sweden has been short of seed of late flowering red clover. In the spring of 1953 all the red clover seed imported was of Canadian growth, and this was true also in the spring of 1957. Since 1953 Finland's imports of Altaswede have averaged 231 tons annually.

In the spring of 1956 red clover seed was imported from the Soviet Union for the first time since 1929, being single cut red clover seed from Perm (Molotov) in the district of Udmurt. Thirty-seven tons of late flowering, single cut red clover

Table 1. Annual Imports (Tons) of Red and Alsike Clover Seed into Finland, 1948—57.

<i>Year</i>	<i>Red Clover</i>			<i>Alsike</i>
	<i>Sweden</i>	<i>Canada</i>	<i>USSR</i>	<i>Sweden</i>
1948	—	125	—	90
1949	153	—	—	—
1950	76	—	—	30
1951	—	—	—	—
1952	220	—	—	32
1953	—	150	—	95
1954	50	150	—	76
1955	89	300	—	60
1956	80	255	40	50
1957	—	300	37	—
10-year period 1948—57	668	1,280	77	433
	33 %	63 %	4 %	

from an unspecified area have been imported from the Soviet Union for plantings in 1957. The table 1 shows the origin of the annual imports of red and alsike clover seed into Finland in the 10-year period 1948—57.

During the last 5-year period, 1953—57, 82 % of the imported red clover seed originated from Canada, 15 % from Sweden and 3 % from the Soviet Union.

Field trials with different red clover varieties which were begun in Finland after the importation of Canadian Altaswede started have shown that Altaswede has not the same hardiness and yield as the Finnish Tammisto red clover, especially in second year leys.

In these trial series made in 1949—52 the hay yield of Altaswede was on first year leys in 13 trials only 8 percent less than that of the standard Finnish Tammisto red clover, but on the second year leys Altaswede yielded 21 percent less than the Finnish red clover (2):

Variety	<i>Relative hay yield, average 1949—52, from</i>	
	1st year leys (13 trials)	2nd year leys (12 trials)
Tammisto	100 (7240 kg/ha)	100 (6780 kg/ha)
Altaswede	92	79

Neither can the late flowering red clover imported from Sweden be compared with the Finnish red clover, as may be seen from some of the later experiments made in 1954—56 and not previously published, in which also Canadian Altaswede was included:

Variety or Origin	<i>Relative hay yield, average 1954—56, from</i>	
	1st year leys (17 trials)	2nd year leys (8 trials)
Tammisto	100 (6600 kg/ha)	100 (6010 kg/ha)
Swedish, imported commercial seed	94	77
Altaswede	84	67

Particularly on the second year leys the Swedish red clover was approximately comparable to Altaswede.

Since the red clover seed problem in Finland, especially during the present decade, has become very difficult to solve because of the great need of imports, it has been necessary to find completely new ways and means. The question has become more and more urgent because it has not been possible to multiply Finnish bred strains of red clover or valuable native strains in Finland. The only Finnish bred variety of red clover, Tammisto, which came to the market already in 1937 and which in most Finnish trials has proved to be a valuable variety,

could not be multiplied within the borders of its own country. The quantities of Tammisto red clover seed which have come on the market have been of no practical significance, averaging only about 3,000 kilograms yearly.

To stimulate the domestic red clover seed production by means of a price guarantee, red clover was included in the law concerning the promotion of seed production in Finland in 1950—54. Under this law a minimum price was fixed for all red clover seed produced in Finland and the State Granary (Valtion Viljavarasto) was obligated to buy each spring all the surplus Finnish red clover seed on the market. However, the law had no practical importance since during the period 1950—54 the production of red clover seed was so small that no surplus seed remained. The new seed law No. 51/1955 covering the period 1955—59 also includes a guarantee for domestic red clover seed (6) but owing to the low yields in 1955 and 1956 the shortage of red clover seed was so great that the price on the free market for instance in 1955—56 exceeded the guaranteed price by 23 percent. At present the main object of the seed law as concerns Finnish red clover seed is to stockpile for poor seed years and thus assure a supply of qualified red clover seed.

After these attempts failed the only way to provide Finland with good quality red clover seed was to organize the multiplying of Finnish red clover strains outside the borders of the country. The idea is not by any means new, for, e.g., both OEEC and FAO work in this way with alfalfa in order to find in the Mediterranean countries new possibilities for the multiplication of seed of North and Middle European alfalfa strains.

The problem of seed production for grassland crops after World War II has been solved in the United States chiefly in regard to alfalfa and red clover (1). The center of these seed multiplication operations is now situated in the Western states (California, Washington, Idaho, etc.), where seed production is very successful with the help of irrigation. Many new products developed by plant breeding in the Eastern states are now multiplied in regions far from their breeding localities and from the states where the farmers will use the seed. Thus in 1956 a total of 30 million kilograms of five valuable alfalfa strains (Atlantic, Buffalo, Narragansett, Ranger and Vernal), or 91 percent of the seed used of these strains, was cultivated in the Western states, mainly in California; that is, outside the actual cultivation area of these strains. In the same way up to 99 percent of the seed of two American bred varieties of red clover (Kenland and Pennscott) is produced outside the boundaries of the cultivation areas of these clover strains.

According to a new organization in the United States (National Foundation Seed Project) it is now possible to multiply newly bred strains in a surprisingly short time. There are many examples of such seed production, both of alfalfa and red clover, during the past few years. The multiplying of Vernal alfalfa, a bred variety from the Wisconsin Agricultural Experiment Station, was begun in February 1953. By the autumn of 1955, after three seasons, the supply of this alfalfa variety had increased to about 2,500 tons chiefly through seed multiplication in California.

The seed yields are many times greater in the Western than in the Eastern states. In 1956 the seed yield of alfalfa was, on an average, only 48 kilograms per hectare in Wisconsin but nearly 9 times as great in California, namely 420 kilograms

per hectare. In the same year the yield of red clover seed was in Wisconsin 47 kilograms per hectare, but in Idaho, which produces most of the red clover seed in the Western states, about 7 times as great or 325 kilograms per hectare (4).

Similar attempts to multiply strains of forage crops are also made in Canada (Canadian Forage Seed Project) (5). Efforts to find the most suitable locations for multiplying different grass and legume species have been made. Thus timothy seed production is there centered in Ontario and that of red fescue and brome grass (*Bromus inermis*) in Alberta. The majority of alsike and single cut red clover seed is also produced in Alberta.

Seed production trials with the Finnish bred Tammisto red clover have been started since 1950 in different localities outside the borders of Finland. During several years an attempt was made to multiply this seed in Sweden but owing to unfavorable crop years only insignificant quantities of seed were produced. Experience has shown that the climatic conditions during unfavorable seed years often are very similar in Finland and Central Sweden, where the Swedish late flowering red clover is produced. Trials with Tammisto red clover are also going on in Central Europe and through FAO in Mediterranean countries.

In my opinion, Canada and possibly also the United States have the best possibilities to solve Finland's red clover seed problem outside the country's borders (3). In the summer of 1955 I had during four months an opportunity to study plant husbandry, mainly in Canada but also in the United States, and to become acquainted with the cultivation of forage crop seeds there.

In Canada, Alberta is the center of seed cultivation of late flowering, single cut red clover. Minor quantities are also produced in northern Saskatchewan and British Columbia. In Alberta there is cultivated land under production more northerly than in other Canadian provinces, but none in the most northern part of Alberta. The Peace River District in Alberta, which is an important seed production area, is situated at about the 56th latitude, or at about the same latitude as South Sweden or Denmark. The southern coast of Finland lies at the 60th latitude. The reasons why certain areas in Alberta have proved to be particularly suitable for the seed cultivation of late flowering single cut red clover are the following:

1) Since the length of day in North Alberta in the summer is shorter than in southern Finland, red clover does not grow as tall and abundant in Alberta as in more northerly latitudes, such as in Finland. The stands of red clover in Alberta are often only 40—60 cm in height and rich in flowers. — The abundant growth of red clover in Finland is generally disadvantageous for its seed production.

2) Honeybees are valuable pollinators of red clover in Alberta. Apiculture is widely spread in the districts where red clover seed is produced and therefore there evidently is no lack of pollinating insects. As the yields of honey are very high in Alberta, it must be assumed that the flowers of various plants are very rich in nectar. — One of the most important reasons for the low yields of red clover seed in Finland is the lack of pollinating insects.

3) In normal years the monthly precipitation during the flowering and harvesting season for red clover in Alberta is no greater than about 50 mm and the end of the summer is nearly as dry as the beginning of the season. The harvesting of red

clover for seed can very often be carried out under favorable weather conditions. — In Finland, on the other hand, the latter part of the summer and also the fall are the rainiest seasons of the year and often very difficult for harvesting.

4) In Alberta the harvesting of red clover seed fields is carried out with combines, which reduces production costs. The fact that the stands are not too abundant in growth nor too rich in leaves facilitates the harvesting work. In fall the relative humidity may be very low in Alberta, and this hastens maturing and raises the quality of the seed. — Due to the humid climate, red clover seed is not harvested in Finland by combine. Its cutting and drying on poles involves much work, mainly because red clover in Finland is abundant in growth and produces much mass.

5) The farms in Alberta are large, the average field area being 100 hectares per farmer. Each seed grower can therefore establish quite extensive seed fields. As there are many new farms there and forage crop cultivation has earlier been small, for instance in the Peace River District, there are no difficulties in making new cultivation contracts with farms on which red clover seed has not previously been multiplied. The possibilities of isolation are good already due to the size of farms. — In Finland, where the acreage of farms is small and where over 50 percent of the arable land is under grass and clover, it is very difficult to keep red clover seed fields isolated from other red clover stands. The multiplying of bred red clover varieties in Finland is difficult also because of hard red clover seeds remaining in the ground from previous plantings.

The first trials with Tammisto red clover were started in Canada in the spring of 1954 for the purpose of obtaining experience concerning its hardiness, flowering time and seed setting as compared with Altaswede, which is the dominating late flowering single cut red clover strain grown in Canada. These experiments are now going on. It is not possible to import new varieties into Canada without Government license even for the purpose of only carrying out the multiplying of seeds for export. However, with close co-operation with the officials it was possible to arrange the first practical multiplications of Tammisto red clover seed in different localities in Alberta in the spring of 1956. The summer of 1957 will certainly yield many valuable results in the work now going on. It is the intention to send each year breeder's seed from Finland to Canada, where multiplying will be carried out during two generations only. The possible genetical changes produced by the multiplication of Tammisto red clover seed in Canada will be thoroughly investigated in Finland.

With the assistance of the United States Department of Agriculture (C. S. Garrison, Beltsville, Md.), trials with Tammisto red clover have also been arranged in some areas of western United States (California, Montana). The most southern locality is situated near the border of Mexico at the 33rd latitude. The purpose of these southern cultivations is, *inter alia*, to illustrate the flower development, seed formation and genetical changes in the Tammisto red clover under conditions greatly varying from those prevailing in northern latitudes, as in Finland. The possibilities for practical seed production of Tammisto red clover in the United States are evidently best in the states of Montana and Washington.

If the multiplying of Tammisto red clover seed can be realized in Alberta or in the northern states of western United States, it will be of great significance to grass-

land cultivation and protein production in Finland, since it has not been possible to multiply this valuable forage crop variety inside of Finland. According to the opinion in Finland, there should be each year a surplus stock of red clover seed of about 200 tons to assure the cultivation of red clover even after poor seed years. If the Tammisto red clover could obtain practical significance also in certain districts of Canada and be licensed there, this would very much ease the situation, because Tammisto red clover seed could then be imported to Finland only as the need arises.

Norway is also interested in the production of single cut red clover seed abroad since, like Finland, it is rather often in need of imported seed. Since, according to long-term Norwegian experiments, Tammisto red clover can be considered suitable for grassland cultivation in certain districts of Norway, Tammisto red clover would be more valuable also to Norway after poor seed years than, for example, the less hardy Altaswede.

As noted above, Finland had in the forties and fifties so many poor red clover seed years that resolute measures must be taken to ensure the cultivation of red clover, the most important forage crop in Finland. Red clover cannot be replaced in this country by any other leguminous plants.

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SELOSTUS:

PUNA-APILAN SIEMENTUOTANNON ONGELMA SUOMESSA

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Suomessa on 1940- ja 1950-luvulla ollut jatkuvasti huonoja puna-apilan siementuotantavuotia. Vain vuonna 1951 ei esiintynyt tuontitarvetta. Puna-apilan siemen on tuotu yleensä Ruotsista, mutta vuonna 1948 ensi kerran Kanadasta. 1950-luvulla on ollut lukuisia sellaisia vuosia, jolloin Ruotsista ei ole saatu

tuontitarvetta tyydytetyksi. Vuosina 1953—57 on ollut säännöllisesti pakko turvautua kanadalaiseen Altaswede-puna-apilaan (taul. 1). Kanadalainen puna-apila ei ole osoittautunut suomalaisen Tammiston puna-apilan veroiseksi.

Kun suomalaisesta puna-apilan siemenestä on ollut jatkuvasti puutetta, on ryhdytty tutkimaan suomalaisten puna-apilakantojen siemenviljelyttämistä ulkomailla. Suurimmat toiveet on kiinnitetty Kanadaan ja Yhdysvaltoihin. Ensimmäiset talousviljelykset perustettiin näihin maihin vuonna 1956 ja ensimmäinen siemensato on Tammiston puna-apilasta odotettavissa Kanadassa 1957.

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