THE SPROWSTON FARM

A Report for Members of the Norfolk Agricultural Station

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This is a progress report for Station Members, and its contents are **confidential**

THE FARMING

In the days when the farming at Sprowston was based on a five-course rotation it was possible to crop in blocks of approximately 80 acres each, leaving only the pasture land outside the block system. With roots, barley, hay, wheat, barley following each other with almost mathematical precision the cropping could be arranged with some certainty for years ahead, and from an experimental point of view this was a very great convenience. The introduction of the pea crop into the rotation in place of the one-year seeds need not in itself have complicated the situation, but the Station's contract for vining peas was fixed at 65 acres, necessitating the introduction of some other crop to the remainder of the seeds shift. At the same time the sugar beet acreage was also limited to 65 acres, so that potatoes were introduced to complete the remaining acreage of both the seed and root breaks. At present the Station has a basic potato acreage of 65, thus making it almost impossible to run on a five-course rotation and still maintain the continuity and regularity of cropping required for accurate experimental work.

The fact that the Station has some 400 acres available for rotational cropping immediately suggests that a six-course rotation would be ideal, with peas, potatoes and sugar beet providing the main bases for the cropping programme. The recent modification to the sugar beet contract which prohibits the growing of brassica crops close in the rotation to the beet crop also calls for careful consideration, particularly if, as in the case of the Station, it is intended to grow catch-crops immediately following the vining peas. It has therefore been agreed that, as from 1963, the cropping on the farm will be revised, and that the farming policy will in future be based on a six-course rotation—sugar beet, cereal, peas, potatoes, cereal, cereal. This will enable wheat to be drilled behind potatoes and also behind the early lifted beet, leaving the remaining cereal acreage for winter or spring sown barley or oats as required. It will also give a complete two-year

break from cereals while the land is under peas and potatoes which should help to keep the fungal diseases which attack wheat, such as eyespot and take-all, safely under control. At the same time there will be a full three-year break between the catch-crops after the peas, which may include brassicas, and the next sugar beet crop.

The change in the rotation will in no way affect the existing proportions of cereals, roots and pulses, but sugar beet, potatoes and peas will be grown to the maximum allowed by contract or basic acreage. Each will occupy one sixth of the arable shift, leaving one half of the farm for cereal production. The re-arrangement will permit catch-cropping after peas with brassicas without contravening the new beet contract regulations. Apart from the commercial considerations, a rotation in which each crop occurs with regularity will be of great advantage as a background to the experimental programme, and will ensure that trials running for a number of years will be completed under identical cropping conditions.

CATTLE

Reference was made in the December, 1960, edition of "The Sprowston Farm" to the live weight gains of young cattle at grass in the previous summer, and to the probable advantages of providing supplementary feed. The Friesian and Angus x Friesian calves reared last winter began to go out to grass by day from 11th April and were turned out completely from the 24th. Between these two dates two groups, each of twelve animals, were selected and matched for live weight, conformation and breeding, and these two groups were grazed separately at Oak Lodge Farm, alternating at fortnightly intervals to eliminate as far as possible any nutritional variations between the pastures.

Until early August one group received no supplementary feed; the other received 2 lb. per head per day of dried sugar beet pulp and/or cereal. When grass became short the first group was also fed some concentrates, but the group initially receiving some supplementary feeding continued to receive 2 lb. per head per day of cereal equivalent more than the control group over the whole grazing period of 199 days. The group average weights at the beginning and end of the grazing season, and the live weight gains over the whole period were:

	No. of animals	Live Weights in Pounds		
		1st May	16th Nov.	Gain per day
Low level feeding				
Angus x Friesian	4	349	642	1.47
Friesian ...	8	404	714	1.56
Treatment group mean	12	385	690	1.53
High level feeding				
Angus x Friesian	4	350	670	1.61
Friesian ...	8	404	757	1.77
Treatment group mean	12	386	728	1.72

On average the group receiving supplementary feeding gained only 37 lb. in weight per head more over the whole period. The difference was rather larger than this for the Friesians, and smaller for the Angus cross animals, but the cross breds in the "high" group came into yards in rather more forward condition than those in the "low" group.

Each group has now been split again for level of feeding during this winter, to see whether the concentrates fed to the "high" group over the summer period would best have been saved and fed as an extra to the fattening ration.

A start has been made this winter with a calf rearing experiment comparing weaning at different ages, with two levels of concentrate feeding. Quite satisfactory results have been obtained from weaning off milk substitute at five weeks from the calves' arrival on the farm, where concentrates have been generously fed. They have been comparable with those from weaning at ten weeks with a limited concentrate allowance, and the earlier weaning has of course saved a good deal of the labour associated with liquid feeding. Not all the calves involved have yet reached the weaning stage, and the full results of this trial will be made available in a later issue.

CEREAL TRIALS 1961

Winter barley time of drilling and manuring trial

Though Proctor is a satisfactory barley in most respects it matures rather late and there has consequently been some interest in growing it as a winter variety, even though it is not frost hardy,

in order to spread the harvest and possibly get some of the grain on the market before prices fall.

A trial was started in 1959 to compare early and late autumn drillings with a normal spring-sown crop, and the 1960 harvest results were reported in Vol. II, No. 5 of "The Sprowston Farm". Information on the correct timing of fertiliser applications for winter barley was lacking, so the 60 units of nitrogen regarded as necessary for a crop following wheat were applied in different ways. The equivalent of 3 cwt. of sulphate of ammonia was given for the winter-sown plots either all as a top dressing in the spring, or split equally between seedbed and spring applications. In the case of the March drilling the same amount was applied either all on the seedbed, or half then and half as a top dressing.

Phosphate and potash were applied on some plots and withheld from others, but there were no significant responses to either of these nutrients in 1960 or in 1961, in spite of the barley being a second white straw crop. This suggests that adequate reserves were present in the soil as a result of heavy fertiliser dressings being used on farm crops in the past.

The early autumn drilling in 1960 went in under good conditions on 5th October and yielded, when averaged for all times of nitrogenous manuring, 36.4 cwt. of grain per acre, but because of the very wet conditions towards the end of the year the "late autumn" treatment could not be drilled until 18th January, 1961; even so it yielded 30.3 cwt. The spring sown crop, which was put in on 7th March gave only 22.3 cwt. of grain per acre.

As in the previous year, the highest yields came from plots drilled in early autumn and top dressed with all 60 units of nitrogen in the spring. This treatment produced 39.9 cwt. of grain, as compared with 32.9 cwt. per acre from plots drilled at the same time but on which the nitrogen was split between seedbed and top dressings.

In 1960 there had been no advantage in splitting the nitrogen application between seedbed and top dressings, but in 1961 there was a 3½ cwt. difference in favour of this method for the January drilled crop, and a very slight advantage from splitting for the spring sown one.

Taken together, the two years' trials show that drilling Proctor in the early autumn and applying all the nitrogen in the spring will give the heaviest yields; though no malting assessments have yet been made on the 1961 trial samples the results from the previous year and experience with farm crops point to the fact that this treatment also produces the best malting samples. There always remains the danger of frost killing the Proctor out in a hard winter, in which case it would have to be redrilled; the likelihood is that the increased cash return from winter drilling

in favourable years would more than pay for this in the few years in which it would be necessary.

The new hybrids in the N.I.A.B. winter barley variety trial mentioned on page 78 show promise of combining the yield and quality of Proctor with winter hardiness. Two of them, with the new spring variety HB.246/5/5 mentioned on page 79, have been included with Proctor in the 1961-62 time of drilling experiment.

Spring barley method and rate of fertiliser application trial

A general description of this trial and discussion of the first two years' results will be found in "The Sprowston Farm", Vol. II, Numbers 3 and 5. It was part of a nation-wide three-year trial series in which 0, 30 or 60 units of nitrogen (equivalent to 0, 1½ and 3 cwt. of sulphate of ammonia) were either broadcast or combine-drilled for spring barley. The plots received a basal dressing of phosphate and three levels of potash manuring were compared, all combine-drilled.

The 1961 results at Sprowston followed very closely those of the two previous years. There has been no response to potash in any season, but as the experiments were in every case carried out on land which had been heavily manured with potash the preceding year for the beet crop this is perhaps not surprising. Though the soil analysis figures showed the potash status to be low they were taken immediately preceding the root break in the rotation.

The effect of combine-drilled nitrogen on the germination of the barley has been serious, and in 1961 the highest level depressed crop emergence by 17% compared with the no nitrogen control plots. This damage due to fertiliser scorch has been significant in all three years of the trial series and appears to present a constant danger from the use of a combine-drill under the climatic and soil conditions prevailing at Sprowston.

The yields in 1961 from plots where 30 units per acre of nitrogen were applied were 1½ cwt. per acre lower where the fertiliser was combine-drilled than where it was broadcast; at the higher level of nitrogen the difference was 1¾ cwt. per acre in favour of the broadcast method. Similar results have been obtained previously, and in no trial in the Sprowston series has combine-drilling given higher yields, though normally differences in yield have been smaller at the lower level of nitrogen.

The plots receiving no nitrogen yielded 26½ cwt. of grain per acre. The first 30 units of nitrogen resulted in yields of 30¾ cwt. where this amount was broadcast, but there was no further response to a further 30 units. The only year in which 60 units of nitrogen proved a worthwhile dressing was 1959, but it must be remembered that the experiments have been carried out on land in a high state of fertility following sugar beet, and

that in other trials where barley followed a white straw crop the increases in yield from higher levels of nitrogen have been more marked.

The results from all three years are quite conclusive and show that with respect to yield there is no advantage to be gained from the use of the combine-drill for barley at Sprowston and that in some seasons the effect on germination and ultimate yield can be serious. It must be stressed however that these results were obtained under conditions prevailing at Sprowston, and on heavier or phosphate-deficient soils, and where lower rates of fertiliser are required, there may be a stronger case for using the combine drill.

The residual effects of organic and inorganic manues

In 1956 it was decided to discontinue the manurial treatments on one of the long established straw disposal trials which had been cropped under a four-course rotation for twenty years. Since then oats and barley only have been grown on this site to measure what residual fertility remained, and in the four test crops taken in 1957-1960 the effects of dung and straw were still showing up significantly. The results were given in the December, 1960, issue of "The Sprowston Farm" (Vol. II, No. 5).

By the end of 1960 it was felt that the level of fertility had dropped so low that an overall dressing of 2 cwt. per acre of Nitro-Chalk (20% N) should be applied to all the plots for the following year's barley crop; this was done, and the 1951 yields in cwt. per acre are given in the table below:

LEVEL OF INORGANIC MANURING (1949–1956)	ORGANIC MANURING (1937–1956)				MEANS (INORGANICS)
	F.Y.M.	Straw early	Straw late	No Straw	
None	19.5	14.8	14.7	12.8	15.4
Low	19.8	16.0	16.1	14.2	16.5
High	20.2	15.6	16.2	14.9	16.7
MEANS (ORGANICS)	19.8	15.4	15.7	14.0	—

The straw was ploughed in at two different times in the original rotation but as might be expected the residual effects from both treatments are similar, and very much lower than those from ploughed in dung. In spite of the overall dressing of nitrogen in 1961 these results show up very significantly, and the yields from the original "no straw" plots were in turn well below those on which straw had been ploughed in.

The surprising fact that emerges from this year's results is that inorganics have produced responses for the first time since the last treatments were applied in 1956. Presumably, in the preceding four years, shortage of nitrogen was the factor limiting crop growth and it was not until the 1961 dressing of Nitro-Chalk that the crop was able to show a response to the small residues of phosphate and potash remaining in the soil from the fertilisers applied at least five years previously.

POTATO TRIALS 1961

Length of sprouting period trial

The use of artificial light in insulated houses for sprouting potato seed is still a relatively new technique, and though it allows a close control to be kept on the temperature and lighting conditions, there is still a need for experimental work to establish exactly what these conditions should be. The varieties commonly grown appear to differ widely in their requirements, and especially in the optimum length of the sprouting period prior to planting. The factors involved were discussed more fully in "The Sprowston Farm" of last March (Vol. II, No. 6) where the first year's results were given for a trial on King Edward seed potatoes subjected to varying lengths of sprouting period, and comparisons included the use of unsprouted seed and seed which had been sprouted but where the sprouts had been rubbed off to simulate careless handling at planting time.

In 1961 this trial was repeated, and a similar one was also done with Bintje, which forms a large proportion of the maincrop potato acreage at Sprowston. The first year's results gave a straightforward picture: the earlier sprouting was started for King Edwards the sooner the potatoes emerged and the higher were the ultimate yields, with unsprouted seed yielding well below all the other treatments. In 1961, however, both the King Edward and Bintje trials showed that yields were higher where the shorter sprouting periods were given, and, though in the King Edward trial unsprouted seed gave low yields, in the case of Bintje this seed gave the highest yield of all.

The relatively poor performance of sprouted seed in the 1961 trials may have been due partly to the severe frosts between May 26th and 30th which scorched the earliest emerged plants from the sprouted seed and could have checked their growth at a critical stage. A further factor of importance may have been the late appearance of potato blight, which allowed the crop a long growing period—to the great advantage of the unsprouted seed.

The one consistent trend that has appeared in both years for King Edward, and for Bintje in 1961, is that rubbing the sprouts off the seed before planting is not as harmful as might be

expected, for the yields from seed treated in this way compared favourably with those of the normal sprouted seed. It seems that, once the seed tubers have broken their dormancy and started to grow, even if the sprouts are removed regrowth quickly follows.

CEREAL VARIETY TESTING

Most Station Members will be familiar with the principles involved in the testing of crop varieties by the National Institute of Agricultural Botany, but it is not perhaps generally appreciated exactly what place the trials carried out each year at Sprowston now take in this scheme as a whole.

For many years the number of new cereal varieties becoming available was sufficiently small for them to be tested in comparatively simple trials at all the N.I.A.B. Regional Centres. These normally were preceded by one year's preliminary trials at Cambridge and observation plots at the Regional centres which eliminated any obviously poor material. As the number of new varieties from British and Continental breeders increased, and the pace of agricultural progress quickened, it became necessary to plan for the more rapid testing of very large numbers of varieties at a small number of special centres. The use of suitable drills and combines now makes it possible to start testing a new variety using only a relatively small quantity of seed, and since 1955 the Station has acted as one of a small number of Preliminary Trial centres which, with the N.I.A.B. Headquarters ground at Cambridge, provide facilities for the initial testing of new varieties on a field scale. As new varieties become available they are normally grown in observation plots at Cambridge for one year, during which seed is being multiplied. Unless they have obvious defects they then go to the Preliminary Trial centres for another year, and any which show promise go on for testing in Main Trials at a larger number of centres for a further two years, after which they may be considered for recommendation. They are not however normally grown for more than the one year in yield trials at Sprowston, and we only see them again in single observation plots. Because of the change in emphasis in the Station's work for the N.I.A.B., members are not able to see the most promising cereal varieties in full scale test at a time when interest is at its maximum, and, in order to try and rectify this omission, simple variety and manuring trials on the more important cereals are being planned which will, we hope, provide useful information.

A Station trial has been started this year in which we intend to look further into the levels of nitrogen top dressing which can profitably be used on the newer winter wheats; we are using in this work not only Cappelle-Desprez but Professeur Marchal and two newer varieties, Viking and Champlein, which have shown promise in N.I.A.B. trials here and elsewhere. As mentioned on

page 73, we are this year using in our barley Time of Drilling trial not only Proctor but three of the new Cambridge winter and spring barley hybrids.

N.I.A.B. CROP VARIETY TESTING SCHEME

After extremely poor drilling conditions during the autumn of 1960, winter sown trials were at first rather disappointing but grew well during the spring and summer and yields were higher than expected. Increased numbers of varieties bred in the United Kingdom were tested in Preliminary Trials in 1961. This was especially true of the winter wheats, and is an indication of the growing interest being shown by commercial breeders in the possible developments which may occur in this country in the future, when they may derive lasting financial benefits from the sale of the products of their work.

Winter wheat Preliminary Trial

As a result of this year's trials at Sprowston and elsewhere only four out of fourteen new varieties tested were selected as suitable for further testing in 1962 in Main Trials. They included 184, a hybrid between Hybrid 46 and Minister, which was the highest yielding and most outstanding variety in the trial; It outyielded Hybrid 46 by more than 3.5 cwt. per acre. Its straw was both short and stiff and although slightly susceptible to mildew it was apparently unaffected by loose smut or yellow rust. The three remaining varieties were Sambo, a Dutch variety with a yield of 3% above the control, and two German mildew resistant wheats, Heine 653 and Heine 4013; the two last were rather disappointing at Sprowston.

Hector and Heine 52, which both outyielded Hybrid 46 by a small margin, together with Cleo and 3051 WA, are retained in Preliminary Trials for a second year. Jufy I yielded well from winter sowing but its sister variety Phoebus was extremely poor, due mainly to severe spray damage which caused a high percentage of speltoid ears to develop. Although looking well in the field Professeur Marchal only equalled Hybrid 46 in yield and both Flamingo and Cappelle-Desprez were unaccountably low, finishing 8% below the control.

Yellow rust was prevalent during the early summer and a number of varieties were badly affected. Viking, although not represented in trials was grown as a farm crop which became badly affected, with up to 75% infection; in the trials the short strawed, red-chaffed variety Redmace was as bad. Mildew remained at a fairly low level this year and although the four Heine wheats in trial were not completely resistant it would appear that the level of infection was perhaps not high enough for them to demonstrate their yielding potential under really adverse conditions.

Winter barley Preliminary Trial

Prominent among the winter barley varieties grown in last year's trial were three HB.292 hybrids from the Plant Breeding Institute, Cambridge. Derived from crosses between Proctor and Pioneer they displayed excellent straw strength and were comparable with Pioneer for winter hardiness and earliness. These varieties, which can be used for either winter or spring sowing, varied considerably in their yielding potential at Sprowston, the best performance coming from HB.292/91/2/5 which outyielded Pioneer by 1.7 cwt. per acre. Preliminary tests have shown that the nitrogen contents in the grain of the hybrids are not far removed from those of Proctor and there is evidence that their malting quality is satisfactory.

Also of interest in the trial was a six-row German feeding barley, Dea, which outyielded Proctor by almost 5 cwt. per acre. This variety was extremely early and possessed stiff straw which had a tendency to lean rather than to brackle. Two additional six-row varieties, Jumbo and Mob Grignon, were similar to Dea in field characters but much lower in yield.

Winter oat Preliminary Trial

Outstanding in this trial was 5370/19/9/45, a mildew resistant oat from the Welsh Plant Breeding Station, which was in trial here for the first time. Although long in the straw, this variety, together with a sister one, 5370/18/2/41, was very early and brackled sooner than most. The shedding of grain in these varieties was very small, whereas in S.147, which remained upright longer, shedding was considerable after high winds and its yield was somewhat low as a result.

A late, but very short stiff strawed variety from the Cambridge Plant Breeding Institute, AB.26/284, with a yield of 35.1 cwt per acre outyielded Powys by more than 3.5 cwt. and stood erect until harvest. Another promising variety, E.2297, from Aberystwyth also outyielded Powys and after three years has now finished its trials period.

Spring wheat Preliminary Trial

Growing conditions during 1961 were very favourable and spring wheat yields were high compared with those of recent years. Jufy I at 27.2 cwt. per acre was outyielded by TB.93/8/6 and TB.93/26/24, two new hybrids derived from crosses between Nord Desprez and Koga I. A further hybrid, TB.92/53/13 (Cappelle Desprez x Koga I), bred as were the others at the Cambridge Plant Breeding Institute was also extremely promising and combined high yield with good field characters.

Several varieties, including Roter Löwe, Opal, and Grano, which had yielded very well in previous years were this year only similar to Koga II in performance. Densi, a German wheat,

reputed to be high yielding was extremely disappointing. Its yield of only 15.6 cwt. was due mainly to sterility and speltoidy in the ears, a condition thought to be induced by herbicides. Although mildew infection remained very low both yellow rust and eyespot were recorded at moderate levels on a number of susceptible varieties.

Spring barley Preliminary Trial

For the second year in succession HB.246/5/5, a mildew resistant barley from the Cambridge Plant Breeding Institute, was the highest yielding of some twenty-eight varieties considered. It possesses excellent straw strength and is several days earlier than Proctor and outyielded the latter by 4.8 cwt. per acre. Information on its grain quality is not yet available.

The advantages of mildew resistance were again demonstrated in a year when this disease reached moderate levels of infection on susceptible varieties. Of the ten varieties which outyielded Proctor only one was heavily infected with mildew; the remainder showed a very high level of resistance. With the exception of X90/39, H.B.246/5/5 and H.B.281/6/3/10 which were bred in the United Kingdom the remaining high yielding varieties were all of either German or Dutch origin.

Ceres and Topper, two six-row varieties from Germany, were disappointing in their yields and proved very susceptible to yellow rust, a fungal disease more usually associated with winter and spring wheats. Climatic conditions were favourable this year for the spread of this disease and appreciable levels of infection were recorded on several varieties. This was the first occasion in twelve years that spring barleys were infected at Sprowston.

Both HB.281/6/5/9 and HB.196/10/5, which are to be recommended by the N.I.A.B. when seed becomes available, were disappointing this season in their final yields. In previous trials their yields have compared well with those of Proctor, and particularly so in the case of the HB.281 hybrid. An early variety from Germany—Juliane—which appeared very attractive during its growth suffered from severe neck breaking just prior to harvest which resulted in a considerable loss of grain. No lodging occurred this year but brackling and leaning in a number of varieties showed up obvious straw weaknesses. Loose smut, which was recorded on most varieties, reached high levels on Freja, Gazelle and Amsel, and HB.246/5/5, CIV 1131 and Bock were moderately infected.

Spring oat Preliminary Trial

Only three varieties in this year's trial were being tested for the first time, and it is evident that progress in the production of new spring oats is not likely in the immediate future to be as great as it has been in recent years. Condor, at 26.4 cwt. per acre, was outyielded only by CIV.1688 (recently named Astor), a Dutch

variety with short stiff straw and reputed to be more resistant to lodging than Condor. A number of varieties in their second and third year of trial, including Flamingskrone, Marino, MGH.462 and Sv.01760, although they outyielded Sun II failed to reach the level set by Condor. Despite a heavy infection of mildew both MGH.856 and MGH.55/161 yielded very well but their straw strength was poor.

Two varieties from the Welsh Plant Breeding Station, 5020/26/1/12 and 5020/9/1/12, although possessing resistance to mildew outyielded the control by only a small margin, thus failing to show any real advantage over susceptible varieties in a season when the level of infection was quite high.

Vining pea trial

Trials of quick freeze varieties have been handled at Sprowston for three years, and changes in technique have been made from year to year in attempts to improve on previous methods. Limitations on the size of these trials have in the past been imposed by both the problem of mechanising the drilling of different varieties and, more important, the large labour force required for podding and shelling by hand.

The Nordsten drill was used in 1961 and this enabled a large trial comparing seventeen varieties to be drilled on the same day. An experimental viner which was designed by the National Institute of Agricultural Engineering was used most successfully for the harvesting. The throughput was very high compared with hand shelling although the final sample tended to be rather dirty. Despite a plot size which was reduced to the absolute minimum it was possible to compare varietal performances at texturemeter readings of 90, 100 and 110. The agreement between the results from Sprowston and centres elsewhere was good, with later maturing varieties generally outyielding the very early ones.

The late Multifreezer, and the medium maturing Midfreezer, Fraser and Frosty were the highest yielding varieties in the trial. Six others, including dwarf and tall strains of Witham Wonder, were low yielding and were all outyielded by the control, Dark Skinned Perfection. In addition to yield data information was also obtained on the number of days to maturity and the proportions of peas in small, medium and large size grades at any prescribed texturemeter reading. It was confirmed for instance that there was a tendency at high texturemeter readings for certain varieties to produce a rather high percentage of peas of the large size grade, thus rendering them less suitable for quick freezing.

With interest in contract crops for quick freezing now increasing it is probable that variety testing in this field will be extended at the Station in the near future.