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CELERY PRODUCTION AND MARKETING
IN THE ISLE OF AXHOLME.

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FOREWORD.

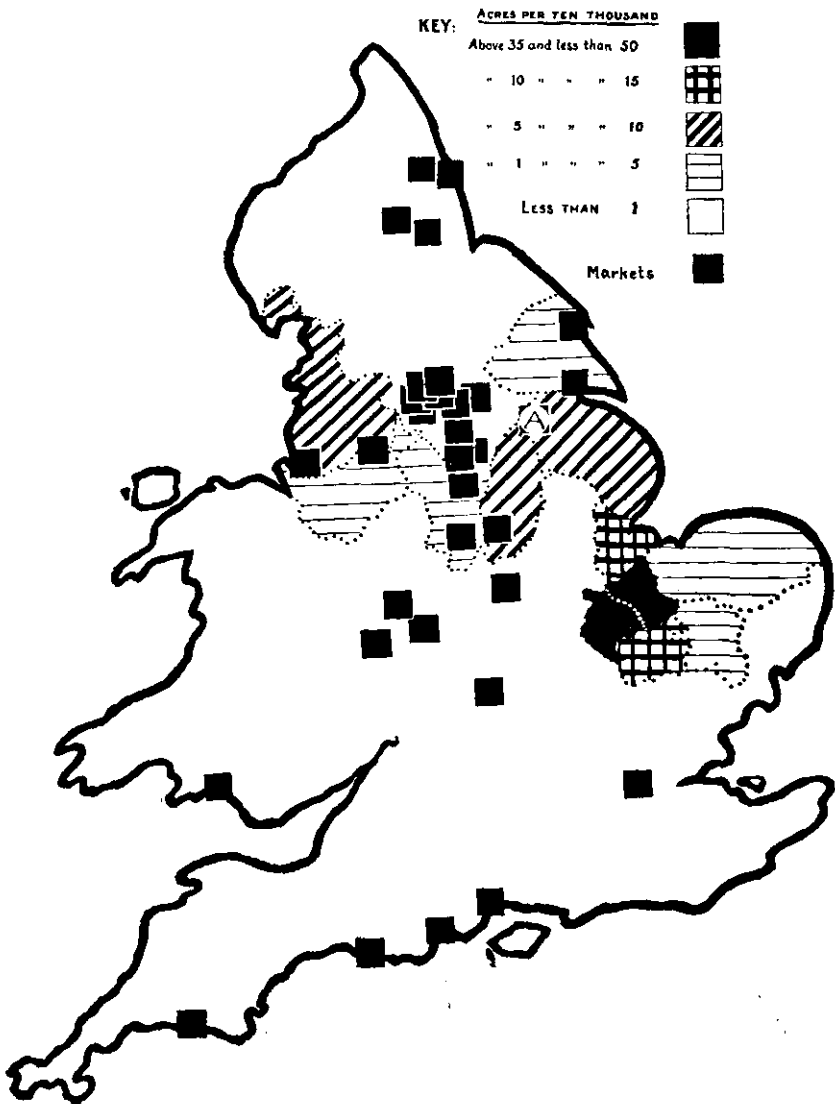
The Isle of Axholme is a low-lying tract of land about 19 miles long and varying from 6 to 9 miles in width. Some 50,000 acres in extent, it occupies the northern corner of Lincolnshire and the north boundary of the Isle is the county boundary between Lincolnshire and Yorkshire. Bounded on the eastern, south-eastern and part of the southern side by the River Trent and on the western and northern sides by the old channels of the Idle, the Torne and the southern branch of the Don it is in effect surrounded by these four water-courses and thus receives its name. Ancient historians record that at the time of the Roman invasion this district was covered with an immense forest and it is suggested that it was the destruction of this forest which gave rise to the extensive stretches of mere and fen that characterised this part of the county for so long.

As early as the reign of Edward III. the inhabitants of the Isle and adjacent parts turned their attention to draining some portion of their land and several drains and embankments were constructed but it was not until the time of Charles I. that the great drainage scheme was conceived and carried into operation by Cornelius Vermuyden. Vermuyden was considerably hampered by the antagonism of the natives, who saw that their precarious livelihood of fowling and fishing would disappear. He failed, in fact, to complete his project but a great part of the Hatfield Chase and the surrounding lands were drained. After his abandonment of the scheme no further improvements were made until the latter part of the 18th century when the old Torne river was widened and deepened and many existing drains improved. Following the 1795 Enclosure Act, several new drains were cut and other improvements effected and, since that time, steady attention to draining and warping and the principles of good husbandry have made this one of the most fertile and productive agricultural areas in the country.

Young* probably makes the first record of the changes that were taking place when he remarks that the division of property obtaining in the Isle just prior to the Enclosures resembled in many respects that of the richer parts of France and Flanders. The population were grouped in villages and hamlets and almost all the houses, except poor cottages on the borders of the commons, were inhabited by farmers. The land was farmed on the family system in small acreages and twenty acres would support a family well. Stonehouse† writing some forty years later, presents a somewhat different picture. He remarks that "Some of the freeholders live decently and respectably; but the greater part are very poor and far worse off than the generality of day labourers"; and, further that ". . . . ten, fifteen, or even twenty acres of land will scarcely support a family who till the ground themselves the smallest of the

* Young—*General View of the Agriculture of Lincolnshire, 1799.*

† Stonehouse—*History of the Isle of Axholme.*



MAP SHEWING AMOUNT OF CELERY GROWN IN ENGLAND AND WALES BY COUNTIES, 1928 AND SOME OF THE MARKETS RECEIVING CELERY FROM THE ISLE OF AXHOLME.
[A : the Isle of Axholme].

INTRODUCTION.

Celery for several reasons is not a crop that is in evidence on many farms in this country but its growing importance in certain areas is noticeable by the increased acreage devoted to it during the last few years. In 1918 less than 3,000 acres of celery was grown in England and Wales, but this figure was raised to nearly 6,000 acres in 1928.* This increase has been general in all the main celery growing counties and is not due to sudden development in one existing area or the opening up of new areas of production. The general increase is shown in Table A., which also indicates the relative acreage position of the chief celery growing counties. Cambridgeshire and Lincolnshire steadily maintain much higher acreages than are approached by the other counties, the former county since 1923 maintaining its position as the highest producer.

TABLE A.

THE CELERY ACREAGES OF THE CHIEF CELERY GROWING COUNTIES DURING THE TEN YEAR PERIOD, 1919-1928.*

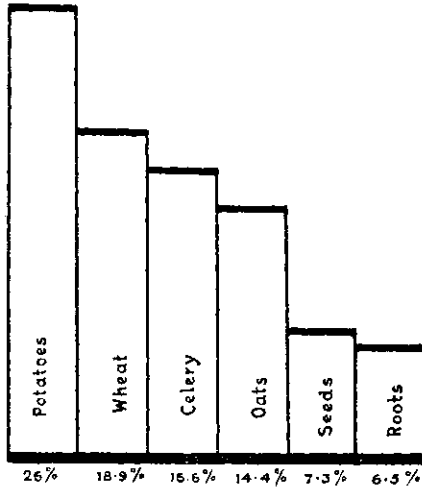
Year.	Cambs.	Lincs.	Hunts.	Lancs.	Norfolk.	Notts.	Yorks.
1919	.. 724	1,043	398	465	404	132	203
1920	.. 899	971	592	537	328	130	181
1921	.. 934	944	600	452	344	159	149
1922	.. 1,029	1,164	762	578	509	273	224
1923	.. 1,062	998	814	600	423	272	234
1924	.. 1,316	1,100	872	719	530	321	270
1925	.. 1,071	840	670	628	330	319	247
1926	.. 1,225	909	805	685	339	375	241
1927	.. 1,370	1,016	875	745	291	383	218
1928	.. 1,452	1,093	845	785	321	354	206

Lincolnshire takes second place in order of acreage and the bulk of the celery grown in Lincolnshire is produced in the Axholme area of the Lindsey division. Many different types of farms contribute to the celery industry in the Isle of Axholme and the extent of the interest of individual holders in the crop varies considerably. Gradations occur from those holdings upon which it is the principal and perhaps almost the only crop to those where it takes a very subordinate position in the rotation. The acreages under various crops have been collected from representative celery growing holdings and the percentage of the different arable crops to the total arable area of those holdings is illustrated in Graph A. It will be seen that potatoes are the chief arable crop in the district; they occupy 26% of the arable area, followed by wheat with almost 19% and celery with nearly 17%.

* Statistics of the Ministry of Agriculture.

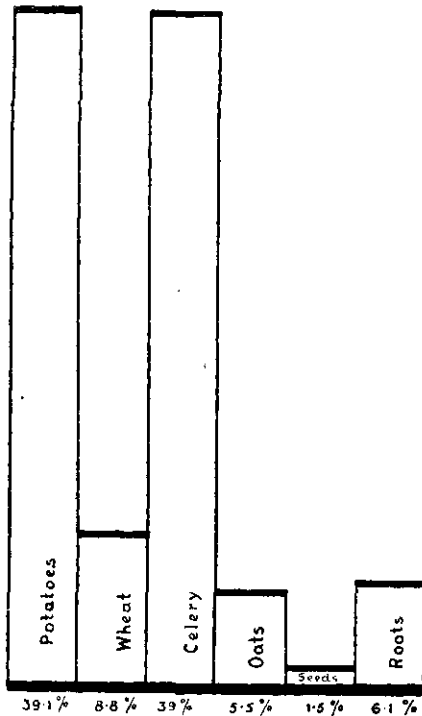
GRAPH A.

THE CHIEF ARABLE CROPS ON CELERY GROWING HOLDINGS IN THE ISLE, PLOTTED AS PERCENTAGES OF THE TOTAL ARABLE.



GRAPH B.

EXPENDITURE IN PRIME COSTS ON EACH OF THE ABOVE CROPS PLOTTED AS PERCENTAGES OF THE TOTAL EXPENDITURE ON ALL THOSE CROPS. (See Text).



Acreage figures alone however, may be very misleading as to the relative importance of the different crops and Graph B. illustrates the comparative financial importance of the various arable crops based on expenditure. To obtain the data for this illustration the prime costs per acre of the different crops have been computed and each crop cost has been multiplied by the acreage of that particular crop on the celery growing holdings from which these data were collected.* Potatoes are still highest with 39·1% but celery is practically equal with 39% and wheat now takes third place with only 8·8%.

It is therefore evident that although potatoes lead in importance both in the acreage and expenditure involved celery from the latter viewpoint plays an almost equally important part. In view of the growing importance of this crop generally and its development in the Isle of Axholme particularly, it was decided to examine the whole question of celery production and marketing as carried on in the Axholme area at the present time. In order to obtain data relating to this problem an investigation was carried out on many of the farms producing celery. In addition a general survey of marketing methods obtaining in the Isle has been made, together with a detailed analysis of the effect of grading on price and demand. The following study is therefore based on these investigations made both on the farm and in the market.

* The prime costs of a crop are those expenses definitely incurred for that crop alone and exclude any charges for rent and rates, hedging and ditching, implement depreciation and repairs and miscellaneous farm expenses.

PRODUCTION.

SOIL AND CLIMATE.

A combination of suitable soil and climate plays the chief part in governing the extent and profitableness of commercial celery production in any area. A deep, friable, easily worked soil with a high percentage of organic matter is essential for the successful culture of the crop, but, whatever the type of soil, the water table must be high and it must be so maintained as to afford a constant and readily available supply of moisture to the crop right throughout the growing season. The necessity for an abundant supply of underground moisture in the production of celery cannot be over-emphasised and many of the areas devoted to the crop in U.S.A. are artificially irrigated. Although a plentiful and continuous supply of moisture is essential for successful celery growing, adequate drainage is also imperative as celery makes very poor growth and is readily susceptible to disease if grown on waterlogged soils.

Celery is grown on a variety of soils in the Isle of Axholme. It may be seen on the Trent-side alluvium, on the belts of warp, the huge tracts of sand and gravel, the large areas of Blown Sand immediately surrounding Haxey, and on the peats of Wroot and Misterton. These somewhat diverse types of soil, however, all possess one essential feature, a high and constant water table. This is due in general to the underlying formation of hard red keuper which prevents immediate loss of soil water through deep under drainage. "The rain, sinking into the Blown Sand and gravel near the villages, merely forms shallow wells, the bands of gypsum and the marl preventing downward percolation."* These bands of gypsum, which are interspersed in the keuper, vary considerably in thickness and horizontal extent and are generally discovered where the outcrops of keuper form high ground between Owston and Epworth. High Burnham, formed by a hill of keuper, is the most elevated spot in the Isle at a height of 133 feet above sea level; the greater part of the Isle is less than 15 feet above sea level. The keuper marl forming the subsoil of most of this district is superimposed on a stratum of sandstone.

As might be expected, the celery grown on the different types of soil varies considerably. The peat or black lands are the earliest and usually give the heaviest yields, whilst the crop is blanched with greater ease and thoroughness than is the case on other types of soil. Such heavy yielding celery however, is often of inferior quality and shows a tendency to coarseness which the best class of celery from the warp and the Blown Sand does not exhibit. Further, it has not the keeping qualities attributable to first class warp celery, and this may force the grower to dispose of his crop early in the season when prices may be unfavourable.

* Bygott—*Eastern England*. p. 127.

Mature warp celery is generally short, sweet and crisp, fairly well blanched and of excellent keeping quality. It is in the main a more desirable type of celery and of finer quality than that produced on the organic soils. This class of celery does not necessarily give low yields since the plants are often set more closely and are usually stocky and well-formed. It is much hardier than the preceding type, and, if well banked, will withstand frost and wintry conditions far longer.

Celery produced on the deep, friable sands and loams is intermediate in quality and characteristics between the two types already discussed. Under favourable conditions heavy yields are obtained and the crop is often ready for marketing early in the season. The plant is generally strong and well developed and it will keep in good condition far into the winter if properly protected. Owing to the kindly nature of the soil it is often possible to work amongst celery on this class of land when warp and peat celery must remain untouched. On those types of soil with a high percentage of sand it is found more difficult to get the celery thoroughly bleached and the appearance of a market sample may suffer slightly by this defect.

The second factor in successful celery production is climatic conditions and this is as important as suitable soil, whilst the value of any soil for celery culture is absolutely dependent upon the seasonal climatic conditions existant in the locality. In addition to an abundance of soil moisture from below, frequent showers in spring and early summer are highly desirable. A warm, bright, sunny growing period, with moderately cool nights and a clear atmosphere are essential attributes of a good year. There ought also to be rainfall of sufficient weight and frequency to maintain the level of the water table and provide an unbroken supply of moisture for the plant throughout the growing season. These conditions are optimum for the majority of celery soils but the growth of the crop is affected in different ways on varying classes of soil by conditions deviating widely from that general optimum. Excellent crops are produced on peat during a showery season whilst such a season is not favourable for the warp grower. On the other hand quite good crops are grown on warp during a hot and droughty summer when the yields from the black land are often comparatively poor.

CELERY GROWING IN THE ISLE OF AXHOLME.

It has been said of celery growing in America that large-scale production is localised in those centres suited by soil and climate and the same statement is true of this country. This results in definite areas being devoted to the crop and recognised as centres of the industry. These areas may be extended beyond their normal boundaries by such factors as a rise in the value of the celery crop when the prices of other agricultural products remain static or decline. They may be contracted through causes such as a series of bad years, displacement by a competitive crop, or the adoption of alternative systems of agriculture; but the industry generally is firmly rooted in such a locality and although it may flourish or decline according to the influence exerted by these factors it is not likely to be entirely displaced. Such localities hold a natural monopoly of the production

of the crop, since if it pays to grow celery at all, most profit is realised in the favoured spots where its cultivation is easiest.

A good example of this localisation occurs in the southern end of the Isle of Axholme, where celery production has obtained so firm a hold on the agricultural practice of the district in the course of half a century as to make it a rival of the potato crop in financial importance.† It is unfortunate that statistics for the celery production of the Isle are not separately available. In consequence the acreage figures given for the Lindsey area must be accepted as a rough index of production in that locality. Although the accuracy of such a figure for this purpose is not unquestionable its use as a guide to trend of production in the Isle is allowable since the acreage of the latter area is the chief contributor to the figure. Accepting this figure as giving a fair indication of the acreage in that area, it is found that production in the Isle has been steadily increasing and has risen in fact, during the period of 1918-1928 from 265 acres to over 730 acres.*

Generally speaking the increasing production of the Axholme area is paralleled by that of the other important celery districts, and is reflected, therefore, in the general trend. Many causes contribute to this common rise and among those of most importance were the inflation of prices during and immediately following the Great War; the steady increase in demand; and the fluctuations in value of potatoes, a crop competing with celery for the greater proportion of the labour on celery growing holdings.

Referring again to Table A. it is noticeable that practically all the important celery growing counties suffered a great drop in acreage in 1925, no doubt owing in a large measure to the cumulative effect of the lower prices realised for the preceding three years. The drop recorded for Lincolnshire is however, almost entirely contributed by the Holland Division and the decrease in celery production in the Lindsey area during that period was very slight.

This deviation from the general on the part of the district including the Isle of Axholme is readily explained. Celery growers in this area may be roughly classified under three types: those who undertake celery production as the chief sphere of their agricultural activities; those who grow celery as one of the main features in a policy based on three or four principal crops; and those who produce a few acres as an incidental side-line. It is the second of these groups that contributes most heavily to acreage fluctuations, since modifications in such a policy generally determine the success of the system. Producers in the first group must either continue in production or substitute with a more profitable crop. So far as celery is concerned their efforts are necessarily focussed on higher yields and/or more economical production. The third group are not vitally interested: the motives underlying their activity are really secondary and many of them value resulting cultural benefits almost as highly as immediate financial return.

Growers in the Isle of Axholme generally fall into the first or third of these groups. Either they cannot effectively modify their

† Graph B.

* Ministry's Statistics.

policy by acreage reductions or such modifications are not influential. Hence whilst production in this area steadily increased with the general trend it is noticeable that heavy falls have not occurred even when such declines were conspicuous in other producing areas.

TYPES OF CELERY GROWING HOLDINGS.

From the point of view of production, celery growing holdings have been classified into those devoted almost entirely to celery production, those where celery is one of a few principal arable crops and those where it is entirely subsidiary to the general farming scheme. It has been pointed out, furthermore, that the bulk of the celery produced in the Isle of Axholme comes from growers in the first and third groupings. It is proposed to review briefly the type of holding most common to each section but the classification adopted is only natural so far as productive policy is concerned and there is no definite boundary between each group.

Of first importance amongst those holders who devote their productive resources chiefly or solely to the celery crop is the producer-dealer. Generally speaking, this type of grower has an interest in the disposal of the crop that is at least equal to his concern as a producer and which is often more remunerative. The size of the holding is frequently in the neighbourhood of fifty acres but may be much higher, and such holdings are often owned by the occupier. Most of this acreage is occupied by celery, although a portion may be reserved for other market garden crops or even potatoes. These holdings produce the better types of celery and their produce is generally first on the market, this being chiefly due to the care and attention which growers in this class are well able to bestow upon their plants.

These producer-dealers usually have an extensive trade in young plants, of which they cultivate large numbers in their own nurseries. It is chiefly due to their activities in this direction that they are enabled to market their celery early since they reserve the earliest and strongest plants for themselves. Many of them, too, grow a certain amount of seed for sale.

Their activities, as previously indicated, however, are by no means confined to the range of production. They usually have a wide connection with commission agents and wholesalers at all the important markets, and by purchasing their neighbours' crops outright, or marketing the same on commission, they are generally well remunerated and at the same time are enabled to dispose of their own produce under the most favourable circumstances. As might be expected, they do not confine their dealings to the celery crop but readily undertake transactions in potatoes or any of the market garden crops produced in the district. This class of holding is by no means numerous nor does it cover an extensive acreage. It constitutes only a small proportion of the holdings in the first group of the classification adopted and the remainder of that group are more diverse in character.

The latter comprise in the main the smallholdings proper: holdings only one step removed from market gardens: some of these are farmed by men with no other resources or means of livelihood—

and this is the closest approach to subsistence farming that exists in the Isle to-day—others, and these are in the majority, are cultivated by men with alternative means of livelihood who have procured a strip of land which they may cultivate in their spare time. Such men may be shop-keepers, railway clerks, millers, postmen or farm labourers; some of them work part of the time on other farms and cultivate their own plot when temporarily unemployed, or in their spare time. Those of them that are more fortunately placed financially hire assistance during a busy time whilst others rely on "family" labour. Such holdings are very small in size and vary from less than half an acre to a few acres. Those holders who are more dependent on their few acres, and who spend more time on their land than in other occupation, generally maintain a few pigs and a batch of fowls.

The method and extent of the cultivations of these small holdings is very varied. Some of the holders, and generally those more dependent on their bit of land, are remarkably industrious, their fields are models of cleanliness, they invest judiciously in artificials and their plots are often highly productive. Others, however, are less scrupulous in their cultivation, they neglect to hire assistance when such a procedure would be a wise economy, they spend no money on artificials and many of them fail to recognise the efficacy of spraying.

It is relevant here to note a common practice in the Isle called growing celery at "Half-part." This is a transaction which enables a person with some capital and no land to co-operate with a farmer to grow a crop of celery. The former supplies plants and manual labour whilst the latter finds the land and horse labour—"horse labour" including the man required to work the horses. The cost of manures is generally distributed on an agreed basis. The resulting crop is often marketed by the party finding manual labour and the proceeds shared equally. The scheme is mutually beneficial. Many farmers who would otherwise be unable to find the labour required in planting, cleaning and lifting, and who have no experience in the disposal of the crop grow celery under this system; whilst traders and others, who could otherwise obtain land and horse labour only with difficulty and inconvenience find their obstacles removed under such a scheme. From the farmer's point of view the intensive cultivation of celery becomes extensive and the other party regards it in the light of an investment of capital, over which he still retains some control, in a business in which he is interested.

To distinguish between the parties concerned in the transaction, the one finding the plants and manual labour is known as the "grower" and the one finding land and horse labour is called the "farmer." The growers' methods of fulfilling their share of the contract are very diverse, varying according to the resources and inclination of the individual. Those belonging to the poorer classes usually raise their own seedlings, often growing them in the kitchen garden; they take an active part in the crop operations and their interests in half-part are generally confined to a few acres with one farmer. They usually co-operate with the same farmer every year and the association becomes a recognised custom. There are, however, half-part growers who operate on a different scale and whose interests are more capitalistic.

These belong to the more prosperous section of the community and may be well-to-do shop-keepers or tradesmen, or even producer-dealers of the type already discussed. They may have no other agricultural interest or they may have land of their own and be actually engaged in celery production on their own account as in the last mentioned cases. Some of these growers, and notably the latter, raise their own seedlings and send their own men to perform part of all of the manual operations. Others purchase their plants, and hire labour throughout, their chief interest being in noting the progress and arranging the disposal of the crop. Many of them have several pieces of celery with resulting economy since they can purchase plants and manures in bulk and can send a gang of pieceworkers from one piece to another.

The half-part growers complete the list of the chief types engaged in crop production with celery as the primary object, and attention may now be focussed on those farms and holdings which produce celery as one of the main features of an arable scheme based on a few principal crops. These holdings are not so common in the Isle of Axholme as in some other celery producing areas. They are generally large in size, and whilst in the Axholme district they vary from one hundred to four hundred acres, in the Isle of Ely there are farms of thousands of acres based on this system. Many of them are owned by the occupier.

About a fifth of the arable acreage of these holdings is generally devoted to celery, a fifth or thereabouts to sugar beet (if this is included in the rotation) and something like three tenths to potatoes which normally plays a prominent part in the cropping of such holdings. Carrots and red beet are frequently included in the scheme and the remainder of the arable produces wheat, with oats and seeds for the horses. Apart from a small acreage grown for pigs, barley finds no place in the rotation since it is difficult and unremunerative to produce a malting sample on these types of soil.

Labour is hard to procure in sufficient quantities at the required times and a large number of regular men are necessarily employed even where the farmers prefer pieceworkers. The nature and extent of the cultivations demand a strong force of horses but it is interesting to note that tractors are not commonly employed. The large-scale nature of this production makes possible many economies in working which would be impracticable on a few acres. The product is generally more standardised and although earliness or exceptional quality are not the chief aims of the extensive producer he is generally on the heels of the producer-dealer in these respects. As a class these are the most enterprising of the growers and they are the first to give trial to new methods of cultivation, manuring, disease control and the use of improved implements. Spraying as a means of blight control was first adopted on this class of holding and its efficacy has now been recognised by these large-scale producers for some years, whilst there are still many small-holders who refuse to attach any value to the process. On these large farms, too, there is a definite tendency to replace the more mechanical of the manual processes by the use of suitable implements and it is pleasing to note that practically all the manual labour of earthing or hilling can be eliminated by the use of a special horsedrawn hiller.

The grower in this group has market connections almost as extensive as those of the producer-dealer. He markets not only his own celery but his own potatoes and other vegetable produce, and in this way maintains a continuous relationship with the wholesaler. In most cases he is lifting celery right throughout the season and can thus keep up a steady supply to his particular marketing agency—a factor which tells strongly in his favour since the small producer can only rail produce irregularly and is therefore at a disadvantage in competing for the custom of the most satisfactory wholesalers. Furthermore, this type of producer is often a keen business man; he knows which markets favour a particular type of celery, he follows market trends and “places” his crop with discretion and he markets his stuff in the most satisfactory condition.

It is unfortunate from the point of view of the development of the industry in the Isle that this type of grower is so largely in the minority in that area. Although it is true that such producers soon reduce the acreage under celery during a prolonged bad period, yet this tendency to reduction has a parallel in all modern competitive industry and as an antidote for over-production has economic justification.

From these extensive holdings under what may be described as semi-intensive cultivation it would seem a short step to the extensive holdings under extensive cultivation that constitute the last class of celery producers, but the difference is well marked. This latter class is composed of the ordinary mixed arable farms common in the area and typical of north-west Lincolnshire. These farms vary in size from about eighty to three hundred acres and are for the most part rented. About a third of the area is grass and the chief arable crops are potatoes, wheat, oats, seeds and roots; the first two provide the bulk of the saleable produce and the extent of the cultivation of the last three is determined in the main by the livestock policy followed. Other saleable crops are produced on a small scale and entirely subservient to the general scheme and amongst these may be reckoned barley, carrots, celery, red beet, peas and sugar beet. Which of these last mentioned crops shall be produced is determined by the operation of such factors as soil type, situation, availability of labour and manure, and marketing facilities. The acreage of such crops is comparatively small but they often receive careful attention. On an average farm of this type it is common to grow about five acres of celery annually, and although this is a small percentage of the area of the farm it is actually as large an acreage as receives the entire energies of many a small scale producer.

On such holdings the seedlings are usually purchased, although in some cases the farmer will grow his own. The amount of attention paid to the growing of the crop varies from farm to farm. Some farmers regard their small celery acreage as a valuable auxiliary to their cropping scheme, and they are as scrupulous in their attention to the crop as is the keenest smallholder. Others give the crop a fair share of their time and labour without being unduly regardful and whilst the crop receives careful cultivation during normal times it is apt to be occasionally neglected at busy periods and suffers somewhat in consequence. Still others expend very little care upon its cultivation: they regard the crop not as a potential source of actual cash

profit so much as an investment in the improvement of the land and from this point of view they are well satisfied if the crop returns are equal to expenditure. Such diversity in the treatment given the celery crop on this type of holding may be attributed to the varying intensity of the farmer's interests and to the experience of the particular farmer in celery culture.

Half-part growing is occasionally encountered on this type of holding. In general those farmers growing at half-part would otherwise fall into the class above mentioned growing the crop without particular interest in its commercial value and without bestowing upon it the attention necessary for success. It is far better for such holders to grow at half-part than to attempt a sort of degenerate production on their own account since the half-part system is partly based on the fact that the grower is enabled to devote more energies to the crop than can possibly be spared by the farmer.

With this class of holding and this type of farmer although the interest in the celery crop is merely subsidiary yet the total acreage devoted to the crop constitutes about a third of the acreage grown in the Axholme area. They are, therefore, a relatively important group of celery producers and the influence of their activities tends to modify wide fluctuations in the trend of production.

Briefly reviewing the three classes discussed it will be recognised that the second group, *i.e.*, those growing celery as one of a few main crops, is the most important in spite of the fact that it constitutes the smallest class of growers in the Isle. It is more difficult to adjust the other two groups in order of relative importance. So far as actual acreage goes the mixed arable farmer, growing celery as a side-line is probably predominant but the small holder and the producer-dealer have a greater interest in the crop.

ROTATION OF CROPS.

On the small holding or market garden type of holding where celery is often the principal crop there is usually little question of rotation and the cropping is varied and fluctuating, providing concrete testimony to unexpected gradations of soil type within small compass and to the experience and foresight of the occupier as much as to knowledge of the advantages of a given sequence of crops and cultivations. It may be that some particular corner of the land is light and sandy and therefore naturally suited to carrot growing, whilst another portion by virtue of its shaded situation or southerly aspect lends itself to the production of early vegetables, and the alert small-holder makes every use of such natural propensities. Other factors—the foresight that anticipates a shortage of supply and an active demand or the initiative that prompts the enterprising man to give a trial to something new—all play their part in determining the policy of the holding and the cropping system for any particular year.

Celery is generally given first consideration on these intensively cultivated holdings, the remainder of the cropping often being subsidiary and planned so as to allow the best of the land for the celery. It is sometimes grown continuously on the same land, both on small and large holdings, and, whilst there are opinions for and

against this practice, the balance of current practical thought seems to favour this system where the land is exceptionally suited to the crop. Against this it may be urged that there is a tendency for the carrying over from year to year of disease (root canker, etc.) and the land may get infested with insect pests (celery fly, *Tephritis onopordinis*, and " grub," *Psila rosæ*). On the other hand the continuous and extensive cultivations and the heavy applications of farmyard manure render the soil very friable and full of humus and after a few years the preliminary cultivations and the manuring may be considerably curtailed.

Intercropping with potatoes is practised by some of the small holders and a more intensive use of valuable land thus obtained. The potatoes are planted in the space between the celery rows and harvested before the celery is banked. The cultivations for the one crop serve in a measure for both right throughout the season and weeds are smothered out by keeping the land covered. However, the hoeing, spraying and customary attention allocated to the celery cannot be performed with the usual facility if the rows are intercropped with potatoes and the potatoes must be lifted early to admit of sufficient mould being pushed up to the celery in the first earthing operation. There are also the additional disadvantages that the more forward growth of the potato foliage tends to make the young celery drawn and etiolated and the denseness of the combined foliage of both crops in the later stages of growth creates conditions very favourable to the incubation and spread of disease. Furthermore, both crops suffer to some extent by the fact that the potato tops are generally trimmed back when beginning to overlap the celery (usually before the potatoes have completed their growth) and the celery necessarily gets some knocking about during the lifting of the potatoes. Where intercropping is resorted to it would be advisable to plant only the earliest varieties of potatoes, and preferably those producing the least amount of foliage, and, in addition, the space between the celery rows should be increased from five to at least six feet.

On the large celery growing farms where the cropping, although often equally diversified, is more consistent, it is the general custom to follow a considered rotation ; but on these farms too, and even where the celery crop is of only secondary importance, it generally receives preferential treatment. Although the cropping policy on such farms is far more inflexible than the systems exploited by the small-holders yet the rotations followed are subject to continuous modification and revision to meet local soil peculiarities or under the influence of changing markets, etc. The greater part of this class of growers practise the following rotation on their celery land, or some modification of the same :—

Celery
Potatoes
Wheat
Oats
Seeds
Roots.

In practically all cases potatoes follow immediately after celery and are succeeded by two white crops. This is due to the heavy

manuring of the celery, sufficient generally being applied to meet the needs of the following crops until the root break and in many instances to carry the rotation round. If the celery was followed by a cereal without the intervention of a potato crop the reserves of humus and organic nitrogen in the soil would cause excessive vegetative growth and result in layering—in fact this frequently occurs even after potatoes following celery (the potatoes receiving no farmyard manure) on some of the warp land.

Where there are no cattle on the holding the seeds and roots are often omitted from the rotation and a second crop of potatoes follows the second cereal. More frequently, however, the roots alone are displaced by potatoes and the seeds are grown for horse fodder. On many of these farms potatoes are the crop of primary importance and the rotation is usually manipulated to allow them a greater proportion of the arable acreage than is occupied by any other crop.*

MANURING.

Except on soils with a very high content of organic matter (*e.g.* peats) heavy dressings of farmyard manure appear to be the first essential of successful celery growing and on the average soil twenty-five tons per acre is a satisfactory application. In addition to this good results are often obtained from phosphatic dressings and four or five cwts. of superphosphate sown down the rows on top of the farmyard manure may, in most cases, be recommended. It may be mentioned here that celery does very well under acid conditions and is therefore a valuable supplement to a potato growing policy.

During the growth of the plants a top-dressing of from 2-4 cwts. of nitrate of soda or sulphate of ammonia will, in general, have an almost immediate effect but in connection with the use of artificial nitrogenous fertilisers a reservation should be made here. On the organic soils already mentioned vigorous vegetative growth is a usual feature of the crop. These soils are naturally well supplied with available nitrogen and there is the grave danger that further applications of this constituent may force the growth of the plants and result in soft or "woolly" stems.

So far as can be ascertained applications of potash salts have not made very appreciable differences to crop yields and since the value of potash dressings is mainly determined by soil type, their application is a question that should be investigated by experiment on any particular farm.

Generally speaking the application of chemical fertilisers is undertaken with the object of making good any deficiencies in the basal organic manuring, to assist the growing crop over a critical period and to give increased yields. The success or failure of an application however, is too often measured in terms of increased yield whilst its effect on the quality of the crop is overlooked. A judicious use of artificials invariably improves the quality of the crop but there are cases, instanced by overdoses of nitrogenous fertilisers, when the reverse effect results. Perhaps if growers had a stronger incentive

* Graph A. Page 10.

to produce a commodity of first class quality this latter view would receive more attention.

The heavy dressings of farmyard manure applied to the celery crop have considerable influence on the expenses of production since comparatively few of the growers produce sufficient manure on the holding and carriage on that from other sources is generally high. Taking the average cost of farmyard manure as collected by records on 30 holdings this is computed to constitute 30% of the total prime costs of producing the crop.

Town manure, usually in the form of stable litter and similar material, is purchased in large quantities by the growers from the chief industrial centres in the neighbourhood. The practice of purchasing town manure by market gardeners in this area has been recorded as far back as 1850 when it was brought by sea from Hull and London and by canal from Leeds and Sheffield. It may be noted, however, that the increase of mechanical means of transport and consequent falling off in the numbers of horses maintained in the cities has considerably reduced the amount of this manure that is regularly available and there are good grounds for the general assumption that the quality has also suffered depreciation. What was originally a problem of the disposal of town stable manure in the character of bulky refuse has in many instances now become a question of meeting the demand for this commodity and it is suggested that the available amount is often augmented by road sweepings, and similarly inferior material.

Comparatively speaking this town manure is still reasonably cheap at the source, usually being offered at from 4/- to 5/6 per ton. As might be expected of such bulky material the carriage is strongly disproportionate to the price, and, if by rail, means an addition of a further four or five shillings per ton to growers in the Isle apart from the expense of carting from the station. In some cases the manure is still brought by water and this method of transport is reckoned to be much the cheaper, particularly where the grower's land abuts on the water-side. Where the grower relies on transport by boat or barge he has no means of checking the weight of manure received.

In consequence of the high cost of this manure to the grower, its poor quality generally, and the difficulty of getting it to the farm at the required time some investigation has been undertaken with a view to determine the extent to which growers are dependent on this supply and to ascertain whether any modifications in policy are practicable which might lessen their dependence. Statistics showing the average numbers and kinds of livestock maintained on 30 holdings were obtained and the amount of manure produced per annum by these animals was computed to be approximately 4,800 tons. The holdings in question comprise 1,925 acres, of which 1,280 acres, or roughly 66% was arable. Assuming that the whole of the manure produced is applied to the arable this would constitute an application of about 3.7 tons per acre per annum, giving a dressing of roughly 15 tons per acre (over the arable) once in four years.

Judging by the standard of the average arable farm this is liberal treatment but under the intensive arable cultivation here practised it is considered far from sufficient. In fact on the 30 holdings under

consideration a further quantity of 2,600 tons of town stable manure was purchased for the celery crop alone and this raises the annual application to almost 5.8 tons per acre, making approximately 23 tons per acre (over the arable) every four years. These figures take no account of the manure purchased for other crops, and, although it is probably less than the quantity procured for the celery (so far as these 30 holdings are concerned) there is no doubt that a considerable amount of the manure applied to the potato crop is purchased.

When it is noted that only 159 acres or slightly under 12.5% of the arable on these holdings was celery it will become evident that the crop must receive enormous dressings. Further investigation shows that approximately 3,970 tons were applied to the 159 acres, giving an average application of almost 25 tons per acre. This is considered a fair dressing for the crop—30 tons being commonly applied.

It is noted, furthermore, that 15 out of the 30 holdings under consideration failed to produce sufficient manure for the celery crop alone—in fact five of them produced none. These fifteen included practically all the smaller and more intensively cultivated holdings, as may be indicated by the fact that although they farmed less than 43% of the total arable area they were responsible for over 65% of the celery acreage.

In connection with the preceding remarks it is as well to emphasise that the factors dealt with are the *total* amount of manure produced (as computed) on the holdings under consideration, the amount of manure purchased *for the celery crop only*, and the celery acreage. Further analysis of the data in hand shows that, out of the fifteen growers who produced enough manure for their celery acreage, eight produced approximately the amount required by that crop or gave an almost negligible surplus. This means that on the 30 holdings referred to, half the growers must purchase manure if they apply it to the celery crop only, but if it is generally desired to apply manure to other crops in addition, more than two thirds of the growers are reduced to the necessity of purchasing. Since other crops do receive applications of manure, and in many cases it is the home-produced manure which is applied to these crops whilst that purchased goes to celery, it would be expected, in view of the above remarks, that at least two thirds of the growers purchase manure *for the celery crop alone*, although it has already been observed that 50% of them actually produce sufficient for that crop. It is therefore evident that 25% of the holdings in question applied part or all of the manure they produced to crops other than celery, additional manure being purchased for the latter crop.

Bearing in mind the fore-going brief analysis it is obvious that the factors forcing growers to rely on the supply of town stable manure are the heavy dressings applied and the inability of the growers to produce sufficient for their needs: there are then three ways by which the grower might lessen his dependence on town supplies:—

1. By increasing the amount produced on the farm.
2. By reducing his applications.
3. By finding a substitute, total or partial.

Since there is insufficient straw produced to render the manufacture of artificial farmyard manure practicable on a large scale the only method of increasing the production of manure on the farm would be through an increased stocking. Judging from general observations and the records collected of stocking on the farms investigated it appears that more stock could be economically carried. It is very doubtful, however, even if more stock were kept, that a sufficient tonnage of manure could be obtained, so more attention must be given to points 2 and 3.

A judicious combination of these two suggestions seems to offer most help towards a solution of the problem. If the application of farmyard or town stable manure could be reduced by half, or even by a third, and the dressing augmented by one or other of the organic nitrogenous fertilisers an appreciable saving in initial cost and in labour expended would probably result, whilst equally good crop returns might be expected. The chief value of farmyard manure lies in its property of enriching the soil through the addition of organic matter or humus, and not in its fertilising constituents, which could be easily replaced. Many of the peat soils on which celery is grown contain more than 25% organic matter originally and it is suggested that on these soils the dressing of farmyard manure might with advantage be substantially reduced and fertilising deficiencies counteracted by the use of artificials. On the sands and warps this is a different matter and since it is necessary to supply large quantities of organic manure to such land if success is to be expected it is suggested that smaller quantities of farmyard manure be tried together with dressings of shoddy, guano, or similar organic nitrogenous fertilisers.

Whether the "farmyard" manure is purchased or produced on the farm it is customary to lead it into a heap on the field during autumn and to leave it in consolidated piles to rot down for spring application. In this connection it may be remarked that those growers who regularly purchase their manure often have difficulty in getting hold of it soon enough to thoroughly undergo the rotting process. Perhaps no practice has persisted against more criticism than has been levelled at the custom of allowing heaps of farmyard manure to rot down exposed to all weather conditions and it is merely mentioned here as one of the factors contributing to the high cost of manuring the celery crop. If growers would take the trouble to put a rough cover over their heaps they would probably be well repaid by the wastage eliminated.

In spring the rotted manure is spread down the rows from carts and evenly distributed by knocking with forks. Some American growers have adopted the practice of using the rotted manure as a mulch around the growing plants with considerable success and it is an idea that might be worthy of trial in this country.

Many growers apply a "tillage"—usually some proprietary compound manure—down the rows on top of the farmyard manure before covering in. This custom of purchasing a ready mixed compound has been very justly criticised since the farmer generally pays far more for the constituent ingredients than if he purchased standard artificials, even if he had them mixed by the merchant. In many cases too, the grower will give his celery a dressing of some compound specially mixed

and sold by the manure merchant as a potato fertiliser. Such regardlessness of the requirements of individual crops leads to unnecessary expense. In this case it may be pointed out that the potash requirements of celery and potatoes are not comparable. An occasional dressing of salt is sometimes applied to the celery and it is claimed that this improves the quality of the crop, making it crisp, brittle and tender.

PRELIMINARY CULTIVATIONS.

The preliminary cultivations vary to some extent according to soil type, the previous crop, and existing weather conditions. The Blown Sand, and, generally speaking, the peat and fenland also, are readily reduced to the fine tilth required for planting the crop but the warp lands and the "broken" soils require more careful preparation. Again, where celery is grown continuously or where taken after a root crop the preliminary cultivations are far less arduous than where it follows a cereal, seeds or newly broken grassland. The weather, too, plays an important part in modifying the extent and nature of the spring operations: after a severe and frosty winter the furrows readily break down. Spring weather conditions have their customary influence on the cultivations carried out during that period and it is here too that the factor of soil type comes again into play for whilst the sand or peat farmer may carry on without much difficulty throughout a showery spell warp land has a strong tendency to "puddle" under such conditions.

The general scheme of cultivations in preparation for the crop is as follows:—The autumn cultivations depend entirely on the preceding crop: if celery is following seeds or a cereal the land is ploughed deep and the furrows are left exposed to the action of the weather until spring. If following roots, potatoes or a previous crop of celery deep autumn ploughing is not considered essential and the land may remain in the rough state occasioned by getting up the preceding crop until the usual spring cultivations. In spring the furrows are dragged down by fairly heavy drag harrows, which may be sent over one, two or three times according to the condition of the resulting tilth. Following the harrowing the land is drawn out into deep rows five feet apart: an ordinary digger type of plough serves for this operation. The plough is generally sent twice down the same furrow, turning out a layer of soil on one side as it goes down the field and a further layer on the other side as it returns. The previously rotted farmyard manure is then carted into the rows and spread at the rate of 25 to 30 tons per acre. This is knocked into the rows in the usual way and if any artificials are to be put down the rows they are sown on top of the farmyard manure. The rows are then split in, leaving a level surface, and if a good mould has been obtained the field may be left until ready for planting. Where the tilth is considered insufficient the light harrow and roller are judiciously used.

When the operations have reached this stage the land is ready for the actual planting of the crop. In practice this is often delayed for a week or so but such delay should be avoided wherever possible and the completion of the preparation of the rows ought to be as nearly as is practicable coincident with the actual planting operation, since when

once the soil is settled and smoothed over moisture contact is re-established and a steady loss of soil moisture through capillary action and corresponding evaporation will be commenced. This factor of the loss of soil moisture is one against which the careful grower is on his guard throughout all phases of the cultivation of the crop and it is very often the case that attention to details of this character makes all the difference between ultimate failure or success.

GROWING THE SEEDLINGS.

Celery shares that valuable characteristic of most market garden crops: it readily recovers from transplanting. It is, in fact, greatly improved by the process. The celery grower takes full advantage of this factor and by germinating his seedlings in frames and planting them out on to shaded beds until strong and well-developed he is able to produce his crop much earlier than would be the case if he was forced to sow his seed direct down the field rows. This also makes it possible for growers who are without the time or facilities for growing seedlings to purchase these ready for planting in the field. It is the more general custom in the Isle of Axholme, however, for the growers to produce their own plants and only 20% of those cases investigated relied upon purchasing. Many of the growers raise far more plants than would suffice for their own requirements and dispose of the surplus to those who have not grown or whose seedlings have failed. In this area, too, it has been the practice to raise large numbers of seedlings for sale to celery growers in other districts and some of the large-scale growers in Cambridgeshire regularly obtain their plants from Haxey and the neighbourhood.

The plants are raised in outdoor frames and the main sowing takes place during the latter end of January and early in February in cold frames, and towards the middle of February in hot frames. The bulk of the plants are grown in hot frames; they come through quicker, get a better start and are generally ahead of cold frame plants at planting out. There has been some improvement in the popularity of growing in cold frames during the last two years, however, and this is due to the fact that the plants are claimed to be less susceptible to "damping off."

The heat of hot frames is provided by using fresh manure—usually town horse or pig manure—which ferments in the frame to such an extent that the warmth can be readily felt by placing the palm of the hand on a bed that has been sown a few days. To prepare the frame for a sowing the manure is forked into the frame and trampled tightly down throughout the filling process until there is a well-packed layer about a foot deep. On the top of this a seedbed of good, dark, garden mould is spread and flattened down by means of a shovel. The soil layer should not be more than three to three and a half inches thick. The cold frames are prepared in exactly the same way but instead of using new manure the rotted manure from last year's frames is again utilised. The soil in the frames may be taken from the garden beds or it may be soil left in the frames from the previous year. In the latter case it is just thrown out while the muck is filled and packed and

then returned on top. The practice of using the same manure, or the same soil, or both, for two years cannot be recommended and where there has been disease in the frames it should be rigidly avoided. After throwing in the soil the surface is levelled off and it is then ready for sowing the seed.

Good celery seed is the first essential to produce strong and healthy plants and in many cases a poor harvest is due to careless selection of seed. Celery "Blight" (*Septoria*) usually results from the use of infected seed and it is astonishing to note how few samples are free from infection. Whilst so much infected and poor quality seed appears on the market every grower would be well advised to have a test for infection and germinating capacity before making his purchase.

At the distance apart of rows and plants in the Isle from 20,000 to 25,000 plants are required to set an acre and these are produced with a safe margin by $\frac{1}{2}$ —1 oz. of seed. Thinner sowing is adopted when it is intended to transfer the plants direct from the frame to the field. The seed is exceptionally small—it has been calculated that there are roughly 70,000 to the ounce—and the growers sprinkle it carefully over the bed a pinch at a time. Sowing is completed by sieving a little fine soil over the bed to cover the seed. In connection with the actual sowing of the seed it is suggested that this operation would be facilitated and a more even germination obtained if the seed was first mixed with fine sand or similar material. Some successful American growers mix their seed with moist "muck" soil at the rate of an ounce of seed to a quart of soil and hold the boxes or pans containing the mixture at a temperature of about 70°F. for a few days until the seeds sprout*. The mixture is then spread evenly over the plant bed and a thin layer of soil sifted over it. By this means a uniform stand of plants may be secured.

Under the methods followed in the Axholme area the seedlings are through in from three weeks to a month. During the early stages the plants need careful attention and particularly so in the case of the first sowings. Judicious weeding, the necessary ventilation and shading the correct amount of watering and the final hardening off must all be performed to that degree of efficiency obtained by extensive practical experience if the best results are to be obtained. The seedling frames are of the usual kitchen garden type, having regular divisions covered by sliding lights which are slid back by degrees to harden off the young plants as they near the transplanting stage. Later on they are removed entirely throughout the day and replaced, or partially replaced, in the cool evenings.

Most seed-bed failures are due either to faulty practice on the part of the grower or to the disease called "damping off." Common causes under the first head are insufficient ventilation in the early stages, too much or too little water (the inexperienced grower easily commits the error of over-watering) and too early or too abrupt exposure. Damping-off is a fungoid disease of which the spores usually survive from one year to the next in the soil and may then

* Beattie, *Celery Growing in U.S.A.*

create a further outbreak.† Warm, moist conditions of the soil are especially favourable to the development of the fungus and overcrowded and weakly seedlings are very susceptible to attack. Fresh soil each year and soil sterilisation, offer the best means of avoiding this trouble and many progressive growers are now adopting these precautions. Thinner sowing might also be considered.

Bedding out generally commences during the first week in April, the plants being taken from the frames and pricked out on to prepared beds. The celery frames in most cases are left idle for the remainder of the year but a few of the more enterprising growers use them as cucumber lights or for similar purposes. The same piece of land is often used year after year for celery beds and very frequently this, too, is reserved solely for the purpose and grows nothing else. In most cases part of the kitchen garden is laid out in beds but where the grower operates on an extensive scale this is sometimes insufficient and old orchard land, unused gardens or allotments and similar enclosures are procured and beds constructed. A few of the large scale growers have nurseries where they produce sufficient plants for their own requirements and a large surplus for sale. The beds must be of deep loose soil with a high content of organic matter. Heavy applications of farmyard manure are dug in during the winter and a rough surface is left exposed to the weather so that when planting time arrives the beds rarely need more than just forking over and raking down.

Gangs of women, girls and boys undertake the bedding out operation and they are generally paid by the thousand at comparatively high rates. The plants are dibbled into the soft mould a few inches apart and soil is firmed round by the hands. An experienced and skillful planter will set from eight to twelve thousand plants per day. Narrow pathways are left between the plant beds to allow for watering and it is necessary to water frequently until the seedlings have fully recovered from the effects of transplanting unless the weather is very showery. Under normal conditions the plants will be ready for removal to the field in from five to eight weeks.

The first indications of Blight are often apparent in the seedling frames or the beds and it is a wise move to give the plants a coat of spray soon after they have been bedded out. When taking plants up, either to transfer from frame to bed or from bed to field all weakly or diseased specimens should be rejected. Some growers allow the plants to make more development in the frames and then plant them direct on to the field. It may be urged in recommendation of this practice that a considerable saving in time and labour is effected and that in a good season the plants make an earlier start since they have to recover from the effects of only one transplanting. Against this it must be noted that the risks from frost and drying out are much greater since the plants are usually exposed at a younger stage. Then there is the additional risk on very light land that such plants are easily buried by the wind. Even where this mode of procedure is most successful the resulting "take" shows an irregularity avoided by double transplanting.

† For further information on this subject see *Damping-off in Celery Seedlings and its Prevention*, Stirrup, Lindsey C.C. Ed. Comm. Pamph.

On the other hand the bedding out process prevents the formation of the tap root natural to the celery plant and a large mass of fibrous roots is produced. This is highly desirable from the point of view of the grower and his plants go to the field stronger and stockier by reason of the slight check they have received. There is also the additional advantage that it gives the grower a better opportunity to select good clean plants. It has already been observed that the first indications of Blight are often apparent in the beds and the careful grower is thus given an opportunity to select only healthy plants and to reject any stock showing evidence of disease. This opportunity for the selection of clean, sound and vigorous plants presents the chief reason for the superior uniformity of bed plants as compared with those taken direct from the frames. It is therefore obvious that the bedding out system is to be preferred since planting direct is adding to the numerous risks already attendant on celery production and often proves a very false economy. This seems to be generally recognised since the former practice is the more widely adopted and large-scale growers very rarely plant direct from the frames. Where the plants are purchased as part of the producer's policy they are commonly bought from the beds and taken directly out on to the prepared field for planting.

PLANTING IN THE FIELD.

The preliminary operations usually leave the soil in excellent condition and it is often only necessary to rake over the mould and mark out the rows before planting. Where the land has been left untouched a few weeks it may require stirring up once more and a little additional pulverising and this is easily accomplished by judicious use of the light harrows and roll. The surface is then hand-raked down to break up any remaining clods and leave a fine garden tilth. It is next marked out for planting and this operation is usually performed by a man in the planting gang who walks across the field dragging one foot in the loose mould to leave a light furrow down which the plants are set. Some growers dispense with marking altogether and plant out by line.

The bulk of the planting out occurs in June. Extremely hot days are avoided as the plants flag very badly in hot weather and a series of hot days may prove a heavy check. The American practice of nipping off a few of the outer leaves from each plant to prevent undue transpiration when planting out during a hot spell is not followed in the Isle. Windy days too, should be avoided for planting out as the wind spins the plants round and round and leaves them very unlikely to grow.

There are two common methods of dibbling in the plants and each has its advocates, who claim distinct advantages for their particular mode of procedure. Followers of the one method set the plants in holes previously punched in the mould by a man provided with a long iron dibbler, whilst adherents of the other actually make the holes and set the plants in one operation, each planter having a short wooden dibbler or "poy" with which he makes the hole to receive the plant root and also firms the soil round it as he places it

in position. From an arbitrary point of view the first method, *i.e.* the use of the long dibbler would suggest itself as a time-saving device, and this is borne out in actual practice, but it would appear from observation that superiority in the use of the long dibbler is confined chiefly to the peats, since the warp, by virtue of its closer texture and heavier nature, does not lend itself with such facility to the operation. Again, whilst separate dibbling and planting are to be preferred where the acreage is extensive it is probable that the grower of one or two acres gains more by the efficiency of planting with the "poy" than he loses by the slightly additional length of time spent on the operation.

The planting is accomplished by gangs, often working at piece-work rates. The planting unit usually consists of three persons: one man hand-rakes the rows and marks them out: another does the actual planting and a woman or girl precedes the planter dropping the plants singly at a distance of 4 to 5 inches. The planter generally travels along the rows on his knees and, punching a hole to a depth of about 4 inches in the mould, he dexterously slips in the plant root, firms the soils around it with hand pressure and a quick dig of the "poy" and passes on to the next. Where the long dibbler is used the planter has no holes to punch and the operation of planting is certainly speedier.

Simple as the practice would appear, either from description or by actual observation of its performance in the field there is no doubt that expeditious and successful planting is a work of skill. The writers have seen alternate pairs of celery rows in a field, the one pair consisting of strong and flourishing plants and the rest of weakly and struggling specimens, and the striking difference in appearance was ascribed solely to the fact that they were the work of two planters, working side by side, the one a skillful and experienced planter and the other a comparative novice. The effect probably being due to the efforts of the unskilled worker to keep pace with his companion and neglecting to firm the soil round the roots of one plant before proceeding to the next. This demonstrates one of the greatest disadvantages of piece labour *i.e.*, work carelessly performed, and emphasises the need for careful supervision.

Many of the smaller growers still follow the old custom of dipping or washing the plant roots immediately prior to planting. Since practically all the fields in this district are bounded by open drains or dykes it is a simple matter to draw a pailful of water from this source, and, taking the plants in bunches, to give the roots a quick swirl in this receptacle before taking them down the rows.

Followers of this practice, with which gardeners are familiar, urge that the young plants get a better start if the roots are washed clean of the old bed soil and that it confers a further advantage in that the roots are wet for planting. Perhaps it should be observed here that a few thoughtful growers during the past year planted rows of washed and unwashed plants side by side and no marked difference in the rate of growth was apparent. It might also be remarked that from a purely scientific point of view the process scarcely justifies the claims made except in those instances where the plants have been taken up from the beds for a length of time sufficient to allow the adherent soil to dry and cake. In the first place the removal of the soil particles

with which the sensitive root fibres are in direct contact would obviously appear to be more injurious than beneficial. Secondly, it is scarcely probably that plants with washed roots are put into the soil in a condition more moist than where the already damp soil is retained round the rootlets: although the time that elapses between washing and planting is comparatively short, yet in the majority of cases it must be sufficient to allow the naked roots to dry through to a greater extent than if their original covering of moist soil had been left intact.

The question as to the advisability or otherwise of taking bed plants to an entirely different type of soil is not one to which many growers devote attention, but there is no doubt that this is a factor that contributes to a large extent to the severity of the check on the growth of the young plant and in some measure to its subsequent development. Plants taken from shaded beds of comparatively warm sand direct on to the cold warp lands are naturally slower to recover from the transition than where they are removed to sand or peat. There are no data available as yet upon which advice on this point might be confidently based but it is a factor well worth the consideration of the grower who intends to purchase his plants.

If the grower has made thorough preparation of the soil, has judiciously selected his plants, and has carefully supervised the actual planting, he has done a great deal to ensure a successful "take," but the weather is the final determinant. Occasional showers, with a modicum of sunshine, reasonably cool conditions throughout the day and no sudden drops in the night temperature, favour the start of the young plants. During a droughty period following the planting out it may be necessary to water the plants in the field but this is the only practical way in which the grower can modify the effects of the weather and the occasions when it is necessary to resort to this measure occur only very infrequently. Unless the conditions are strongly adverse the celery quickly recovers from the effects of transplanting and after the elapse of a week or so those plants that have failed to make growth are replaced. This process is known as "gapping" and it is customary for the grower to reserve a bunch of strong plants from the planting out for this purpose. When conditions are unfavourable or plants are weak or attacked by "grub" it may be necessary to repeat the gapping one or more times but the result is an irregularity of growth and an unevenness in the rows that is not evident where there has been a good first take.

CROP CULTIVATIONS.

Under favourable conditions the young plants soon establish themselves after the planting operation and recommence growth: but the conditions that favour the recovery and vigorous growth of the celery are also ideal for the rapid development and spreading of the numerous weeds common on this intensively cultivated land and particularly on the peat and sand. The grower, therefore, is soon busily engaged with the hoe keeping his celery clean, and when it gets sufficiently high and strong the horse-hoe or "scuffle" is brought into use and put down the rows at intervals dictated by the weather conditions and growth of weeds. Hand hoeing round the young plants,

and also the use of the horse hoe down the middles of the rows to some extent serves to create a mulch that influences the rise of capillary moisture. Close cultivating of the plants is probably of as much value from this effect as from its primary object as a check on weeds.

Where blight infection has been noted or where preventive measures are desirable spraying down the rows must not be neglected. The time of spraying and the manner in which it is carried out are generally dependent on weather conditions, the state of the plants and the resources of the grower. Whilst the plants are small once down the rows with a knapsack sprayer will generally suffice to give the leaves a good coating of the spray. As the plants become larger, however, or where badly infected it becomes essential to go over each row two or three times if the ordinary knapsack is used: once along each side and once down the tops ensures that all the foliage gets a protective film. Horse-drawn sprayers are obtainable which spray both sides and top of the rows thoroughly at one operation and since these are often constructed to take two and sometimes three rows at once their use is very economical where large areas are to be sprayed.

Ordinary Bordeaux and Burgundy mixtures are very effective against celery blight and they are easily and cheaply made up on the farm. For good results it is essential that these sprays should be applied during a dry spell since the protective film is easily washed off the leaves during the first twenty-four hours. Some growers have used powder sprays with good results, spray material being blown over the plants in the form of a very fine dust. Dust spraying is usually carried out when the foliage is damp from a recent shower or early in the morning when the leaves are still wet with dew. Although good results have been obtained, particularly during showery seasons when wet spraying has not been as effective as usual, it is generally considered that wet spraying is more efficacious.*

Whilst the grower is busily keeping down the weeds by his inter-cultivations and holding blight in check by spraying the crop soon reaches that state when a little earth may be pushed up to the roots as a preliminary to the earthing operation. If the rows have been regularly scuffled or hoed there should be sufficient mould for what is commonly called the first furrow. Where it is considered that there is insufficient depth of mould the row middles are purposely scuffled down and a light ridge of loose soil is then thrown up on either side of each of the celery rows by means of the digger plough. The field may now be left for a couple of weeks or so until the plants have made appreciable growth.

By this time the plants ought to be about the height of a man's knee and the earthing operations proper, with the object of blanching, may now be commenced. The scuffle is again sent down the row middles but a greater depth of mould is required this time and it may be necessary to use two horses for the operation. This is particularly the case on the warp land. The digger follows again precisely as before except that more earth is thrown up and it may be necessary (on warp) to use three horses, with a boy to lead the first. It is now customary

* For further information on the question of spraying see *Celery Blight and its Prevention*, Stirrup and Ewan, Midland College Bulletin No. 14.

to push the soil at the crests of the ridges close up to the stems of the celery so that they are firmly packed together and the light excluded. Old brooms or light wooden boards nailed on the end of handles and similar in construction to an ordinary broom are used for this purpose. After the second furrow the plant is allowed to make further growth until the third or banking furrow is thrown up.

Where the crop is required for an early market the final banking is completed in a very short time and the plants are soon blanched sufficiently for lifting. If the crop is at all backward, however, or if it is to be held well into the winter the third furrow and completion of the banking operations are delayed as long as practicable and this may be until threatened hard weather enforces more complete protection.

Before throwing up the third or banking furrow the row middles are thoroughly scuffled up to provide the necessary loose mould. A special breast is attached to the digger to throw up the soil to form the required bank. Three horses are invariably used for this operation and on some of the warp land four may be necessary. The horses walk down between the rows in single file with a lad at the head of the first. It is part of the boy's duty to unhitch the first pair at the end of each row so that the other pair may draw right out with the plough and turn round, but he soon becomes very efficient in this uncoupling and coupling up again and less time is lost than might be supposed.

When the banking furrow has been thrown up the soil is once more pushed around the celery tops. If it is desired to get the celery bleached and marketed early the rows are straightway topped but where the celery is very immature, or where it is to be left until late in the season, it is allowed to make further growth before topping. The operation of topping, often simply called banking, is done entirely by hand and it is frequently let out by the piece. It consists in packing the soil around the tops of the plants by means of the spade, rounding off and completing the work of the digger and the pusher and flattening and smoothing the sides of the ridges. The soil is now packed right up to the stems of the plants in such a manner as to leave only the upper green leaves protruding and the celery is now protected from ordinary wintry conditions. This final topping up is very heavy work and proves a costly item to the grower whether performed by his regular men or let out by the piece. With the completion of the earthing up the crop cultivations are at an end until lifting takes place and under normal conditions the plants will be well bleached in about three weeks.

Earth bleaching is the only method practised on a field scale in the Axholme district but in view of the laborious nature of the operation and the correspondingly heavy expense it is suggested that the alternative methods employed in the large celery producing areas of the United States might be worth consideration. These are bleaching by means of boards or by specially prepared strips of paper. Where these methods are employed the rows may be much closer together and it would be possible to almost double production from a given piece of land by adopting such means in this country. It must be remembered however, that in the U.S.A. where these methods are practised shorter and easier bleached types of celery are grown.

The boards are placed along the celery rows and held by stakes during the first stages of blanching. After a few days, when the tops of the plants have grown level with the boards the latter are pulled together at the top and held in position by wire spanners. The celery is bleached in about two weeks and the boards may be used several times during a season. At the close of lifting the boards are stacked in a pile with strips of wood between to keep them apart and the top layer placed in the form of a roof. If properly looked after good quality timber will last from ten to fifteen years.

Special heavy paper in widths of about a foot and lengths of from 100 to 300 feet is also used extensively in the States. It has the advantage of being easier to apply than boards, but its life is much shorter, although if strengthened with lines of stitching or reinforced edges to prevent tearing it may be used three or four times a season for about three years. The paper is applied to the plants with the aid of rollers and taken off in a similar manner. It is held in position by wire brackets or arches.

Paper bands around each individual plant or ordinary farm drain-pipes of about 3" bore give exceptionally good results but such methods are only practicable on a very small scale.

With regard to the common process of earth bleaching it may be pointed out that this practice might be considerably cheapened if the manual labour could be appreciably lessened. Although modification of present methods to attain this end are generally regarded as somewhat ambitious there appears to be no valid reason why horse-drawn hillers may not be constructed that would raise the banks sufficiently high and pack the soil round the celery in such a way as to make pushing and topping unnecessary. Where the crop is grown on a large scale such an implement would materially lessen production costs.

LIFTING.

Those growers who aim to catch the early market are often lifting by the end of August. This will be white celery, grown on the sands or peats, and the bleaching period, generally about two weeks for this class of celery, is shorter than would be the case for main-crop, due in part to varietal characteristics as regards colour, in part to the fact that celery usually bleaches quicker during warm weather, and finally to the fact that growing celery is always more easy to bleach.

The stage at which the crop is lifted is determined in practice as much by the urgency of market requirements as by the extent to which it is bleached and the prices for early celery are often lowered appreciably through the appearance of a lot of poorly bleached and immature stuff sent in by the grower anxious to take advantage of the early market. In no case however, ought the celery to be lifted until the outer leaf stems are properly blanched for at least one third of their length. This would ensure a good sample after trimming.

Lifting, whether accomplished by regular labour or let out by the piece, is generally undertaken by gangs with a unit of three. On the peat and sand one man goes first and, using a broad spade, digs off one side of the celery row and cuts off the celery roots at the base. This leaves the plant stems exposed on one side and cut off at the

bottom and the trimmer follows picking up each root, shaking off the loose soil and pulling off broken, diseased or withered leaves. The trimming is often done by a boy of 15 to 17 years. Following the trimmer comes the tyer. He carries willows and band and ties up the celery into bundles of a "dozen" roots tied at the bottom with willows and at the top with band. Tying is a skilled operation and a man must be well practised to keep pace with the digger and trimmer: he places the willow and band on the ground, selects four good roots for the bottom layer of the bundle, four, five or six smaller ones for the middle and four more good ones for the top. He then pulls up and tightens his band, and his willow, picks off a few loose or broken leaves, and the bundle is finished and ready for market. Bundles tied by a skilled man are neatly and tightly made, square in appearance and uniform in size throughout. When the crop is irregular some growers may have the bundles tied in two sizes but it is the more general custom to make one size of bundle and put several small roots in the middle where the unevenness of the crop makes this necessary. Thus it is that although a bundle is supposed to contain twelve roots it may contain twelve only or any number of roots above twelve. The practice of putting the smaller roots in the middles of the bundles is very undesirable and will be referred to again.

On the loamy types of soil and on the warps it is customary to plough off a layer of soil from the roots before lifting commences. This eases the work of digging out considerably on such land. Following the ploughing out the operations are essentially similar to those described for peat and sand.

When lifting it is usual to take a cart down the rows and collect the bundles. Sometimes, however, the land may be far too wet to allow the passage of a laden cart down the rows and it then becomes essential to carry the bundles on to the headlands. Occasionally, in fact, it is found necessary to take up the celery and carry it off where the water is standing in the furrows even on well-drained fields and the men are equipped with waders. Under such conditions as these lifting becomes a very costly operation and such measures are only resorted to during a very wet time when the market demand is imperative.

The celery is generally led off as it is lifted and carted direct to the railway waggon, motor lorry, or other means of transport to the market. The grower as a rule organises his work so as to lift no more than can be moved on the same day but where it is found necessary to lift a few days in advance the celery is usually pitted in the field. The pit is made down one of the ridges and if the celery is to be left for several days in the winter a shallow furrow of soil may be turned back and the ridge widened and levelled, but where it is only made for a couple of days or to stand over a week-end little preparation is necessary. Pitting consists in standing the bundles upright in the pit, and the pit is usually three bundles wide and as long as desired. Soil may be thrown up round the outside if frost is at all probable and when the soil is very wet the bundles may be protected by a layer of rough straw, which prevents the outer stems from being unduly soiled. Celery may be left as long as two weeks in the pit in the middle of the season but after Christmas it soon begins to rot under

these conditions. Pitting has been resorted to for ripening off and completing the bleaching of plants taken up too early—cases are in fact noted where plants have been taken up in a partly bleached condition and finished off by pitting. For this purpose the pits are made much wider at the base and the resulting heating blanches and forces the celery to the required condition. Great care must be taken to ensure that the plants are not over-heated by this process.

After September celery may be lifted at any time convenient to the grower unless weather conditions are too adverse. Plants make very little new growth and blanching is generally complete, any changes that may occur being in the way of deterioration. Heavy frosts are dreaded by the grower since he cannot move his celery when it is frozen up and immediately the thaw sets in it starts to deteriorate. A heavy frost followed by dull, warm days, does far more damage than if the weather remains cold and snappy, for frozen celery soon commences to rot in a rising temperature.

Growers dispose of their celery in various ways and they may sell the standing crop on the field or they may send it away to be sold on commission, but by whatever method it is sold—even in those cases where the purchaser has to lift the crop—the grower generally contracts to cart it to the station unless it is to be transported from farm to market by lorry. Arrangements are made for empty railway waggons before lifting commences and the bundles are usually carted to the station as fast as they are lifted and tied. Celery is usually packed upright in the waggons, *i.e.* the bundles standing on their base with the foliage uppermost, and an ordinary ten ton waggon will hold four hundred bundles, which will weigh on the average between three and four tons. Where the grower is railing large consignments he may pack celery in two or even three layers with the bundles laid flat, but if in more than two layers the lower bundles are apt to be damaged. Where two layers are packed it is generally advisable to lay the bottom layer flat and stand the top layer upright. In this way none of the stems are exposed and the celery is not so subject to the risk of drying out in the warm weather early in the season, or to the danger of frost later on. When railing celery early in the season many growers have a watering can handy and sprinkle the celery as it is packed: this is a safeguard against drying out. The waggon cloth is pulled over and fastened down as a final precaution. The waggon sheet may be fastened down directly covering or in contact with the celery, or it may be fastened over the top of the wagon in the usual way. Where it is fastened directly over the celery—and particularly where sprinkling has been resorted to—the celery heats slightly during transit and if poorly bleached when loaded it may be improved a little by these means. The process involves some risk, however, and celery may be seriously damaged by overheating.

Another precaution against drying out is the covered waggon: one grower states that he never packs his celery in a double layer in September if he can get horse boxes. The value of the covered waggon for railing celery might receive more attention since it has advantages under extremes of temperature. When railing frozen plants these must not be covered down closely by the waggon cloth as they will probably thaw under such conditions and the resultant over-heating might spoil the consignment.

MARKETING.

FACTORS GOVERNING CHOICE OF MARKET.

Celery is despatched from the Isle of Axholme at some time or other to almost all the wholesale markets of any importance in the country and the factors determining the market destination of the crop are many and varied. The London market, for example, is noted as an excellent market for early celery of good size and quality but, except for a small quantity of the best stuff, growers in the Isle cannot successfully dispose of their celery in London until the large early white has been cleared from the areas definitely devoted to market gardening. Hence the choice is determined to some extent by the condition and value of the celery crop in other producing areas—where such a crop is of better quality than that produced in the Isle it commands first consideration in the best markets. On the other hand there are markets which are generally recognised as more favourable for the disposal of inferior celery. These are chiefly big industrial centres where a large quantity of this poor quality celery is trimmed and washed and sold from hawkers' barrows or baskets. Celery not reaching a good standard is immediately consigned to those centres where it sells readily "at a price." It may be noted in this connection that inferior grades sell readily at Leeds and Birmingham, at Bradford however, the merchants dislike sand land celery on account of its bad colour—(this class of celery does not bleach very well).

Another factor of importance in determining the destination of the crop is the proximity of the markets to the grower. In the form in which it is marketed at the present time celery is not of great value in proportion to its bulk, and heavy carriage (which is proportionately higher on small consignments) has to be paid. (It is therefore often more profitable for a grower to take a low price nearer home than to send his produce further afield for a higher figure which would not justify increased freightage.)

Custom also plays a large part in the disposal of the crop, particularly in the case of the small grower consigning his produce direct to the dealer. Such a man will probably be acquainted with one or two commission agents at different markets with whom he is constantly in touch. These are the men he naturally refers to when he has produce for disposal. Small growers have some difficulty however, in making a connection with good wholesalers or commission agents, and they will often continue to market their celery through unsatisfactory agents because they lack the initiative to find better, or fear the risk of making a mistake. It is not very easy for a smallholder growing a few acres of celery to get in touch with wholesalers and commission agents. His neighbours are reluctant to give him the destination of their crop lest his consignments should adversely influence their market. Many of the larger firms of

wholesalers purchase through a local dealer and a small grower making enquiries is immediately referred to that dealer. Furthermore, should the small grower find a reputable firm willing to handle his produce direct he cannot expect such preferential treatment as is accorded to the larger growers and local dealers since the latter are able to forward a steady supply right throughout the season whereas the small grower can only make consignments when his crop happens to be ready and he may often be forced to bulk it all on the market in a few weeks.

The factor of most importance in determining the market destination of celery, however, is that of price. Local dealers still handle the greater proportion of the crop: they buy up the acreages of the "small" men (generally by piece) and consign it to those markets where highest prices are ruling. They are in touch with commission agents and wholesalers in all the big markets; they study marketing conditions and whether they are purchasing outright and selling on their own, sending on commission for the grower, and/or acting purely as local agents for firms of wholesalers, it is in their own interest to get the best price possible and the celery is consigned accordingly. The large grower, too, keenly follows market trends and is very ready to avail himself of fluctuations at different markets. Even the enterprising small grower who does his own marketing and who cannot maintain connections in many markets takes every advantage of any variation in wholesale quotations that may come to his knowledge.

METHODS OF DISPOSAL.

The disposal of the celery crop by the grower is effected primarily through one of the two main channels:—

- (a) Local sale.
- (b) Sale in distant markets.

(a) The first method is more commonly adopted by the small grower and although nearly 50% of the cases examined marketed their produce in this way yet they were responsible for less than 20% of the total acreage under consideration. As explained in a previous section the local dealer is usually a producer as well: by judicious purchasing to augment his own supplies he can keep up a steady supply of celery to the firm with whom he is a regular dealer and he thus receives preferential treatment. To reinforce his own supply of celery therefore, he will purchase outright from time to time small acreages from those growers who lack the initiative, capital, or facilities to dispose of the crop themselves. The celery is generally purchased by bargain on the field; the dealer usually undertaking to provide willows and to lift the crop, with perhaps some agreement for the grower to plough back a furrow from the bank and provide horses and carts to get the celery to the station. In those cases where the dealer and grower fail to make a bargain over the crop by piece or by acre the dealer may purchase by dozen or bundle and the grower will then undertake to lift.

This method of outright sale has advantages to both the grower and the dealer. From the point of view of the grower it provides a safe means of disposal since he knows immediately the price he is to

obtain and avoids all risk of loss either through market fluctuations or from frosts, floods, or similar causes. In most cases too, the smallholder will get a cheque for all or part of his crop as soon as the bargain is concluded and this is often a matter of some importance to the "small" men, many of whom are short of ready money at this time of the year. Furthermore, the smallholder who makes a careful bargain will often get a better price for his crop than he would make by sending on commission, since the dealer is in a better position to obtain good terms from the commission agent or wholesaler and in many cases he can clear a useful surplus on the deal whilst paying the grower as much as the latter could expect to receive if he marketed direct. From the dealer's point of view the chief advantage of buying the crop on the field lies in the fact that he can take up and market at his own convenience. He can therefore maintain steady supplies to his regular wholesalers after his own crop has been lifted. Sometimes, too, he is sending to a firm who make exceptional returns for first class produce and he finds it good policy to buy up really first rate stuff from the smallholders to meet these requirements.

(b) There are three avenues open to the grower for disposal of his crop in distant markets :—

- (1) Marketing through local dealer on commission.
- ✓ (2) Consignment to market commission agent.
- ✓ (3) Outright sale to market wholesaler.

(1). Many of those smallholders who refuse to sell their crop outright to the local dealer and a large proportion of those farmers growing the crop as a sideline dispose of their celery on commission through the local dealer. In these cases the grower may suggest the market to which he would like his crop to go but it is more usual to leave this to the discretion of the dealer. Generally the grower will get in touch with the dealer and ask him if he could send off some celery. The dealer will ascertain the quality of the crop and approximately when the grower would like to market. He will then inform the grower, a few days in advance, when to put it on rail. In such cases the dealer may never see the crop: he merely acts as the first intermediary and is remunerated by a commission charge. This commission may be based on the price realised but it may be a sum fixed in terms of the quantity consigned irrespective of the price made. When the crop is marketed in this way the local dealer receives the usual account sales from the commission agent, makes a further deduction for his own services, and pays over the remaining amount to the grower. It naturally follows that the chief disadvantage of this method lies in the additional amount of commission incurred.

(2). The larger growers and the more enterprising of the farmers and the smallholders despatch their crop direct to the commission agents and wholesalers in the big market towns. By far the greater proportion of the crop is marketed in this way although growers are generally dissatisfied with the system. The growers marketing by this method are usually acquainted with one or two commission agents at some of the principal markets. When they have a crop ready for lifting they get in touch with these men and ask what returns they

are making at the present time. Choosing the most favourable reply they offer to load a consignment and if a good price is realised further railings are made to the same destination. Under this scheme the grower runs all risks and pays all charges on a consignment until it is actually sold. Deductions are made from the cash returns received on sale of the consignment to cover railway carriage, portorage, market dues, and commission. Very often the grower is a poor business man : he pays heavy commission and other charges without investigating their nature or the basis on which they are levied. On making enquiry it was found that only approximately 30% of those growers sending regularly on commission could give the rate of commission charged and in these cases as well as in others where a calculation was made on returns shown the general rate appeared to be $7\frac{1}{2}\%$ of the gross amount realised by the crop. It is after commission has been deducted that charges for carriage and incidental items are made. In some cases investigated however, the rate of commission could not be discovered since the grower had merely received a cheque for the celery sold, commission and other items having been deducted with no statement made to the grower. Many growers are quite unaware of the fact that in all cases where an advance note specifying the nature and description of the consignment is forwarded to the commission agent the latter is legally bound to render accounts to the consignor showing the actual price paid for the goods, and, where that price varies, the number, weight or quantity sold at each price, together with details of commission charged and all amounts paid by the salesman on behalf of the consignor in connection with the sale.*

(3). Selling outright to the wholesaler was at one time a very popular method of disposing of the celery crop but wholesalers now obtain their produce by other methods rather than by actual contact with the producer and it is very rarely now that outright sale is effected. There is no doubt that when such a method was practiced it was advantageous to the grower but present day specialisation has displaced this practice.

ADVANTAGES AND DISADVANTAGES OF SYSTEMS OUTLINED.

Any method of disposal which introduces the local dealer merely as a medium of sale, whether he buys outright or acts as a commission agent may be criticised as introducing an unnecessary link in the chain connecting the producer and the consumer. Against this it must be observed that the local dealer, although by no means indispensable, does serve a useful function as a marketing agent for the smallholder. He is well connected with wholesalers, he can follow market trends with facility and his wide experience has left him in a better position to dispose of the crop than is the small grower. Where he purchases the crop outright this is reflected in the price he is able to pay and when acting on commission his returns to the grower will very often compare favourably with returns direct from

* Horticultural Produce (Sales on Commission) Act, 1926.

central market agents. An advantage already mentioned is the fact that he is able to make an immediate cash payment when purchasing from the smallholder.

Direct raiiling by the grower to the market commission salesman appears to be the best of the methods of disposal practised at the present time but this system is by no means ideal. In the first place the celery is at grower's risk until it is actually sold and losses through deterioration in transit or before sale, or considerable price reductions due to market fluctuations devolve upon the grower. In these matters the grower is entirely in the hands of the commission salesman, and although unscrupulous agents are probably more rare than might be suggested, more security for the producer would meet with general approval. Of course the grower may go to the market and see his produce sold, or he may even assert his rights to the extent of making an examination of the agent's books, but the former course would involve too much trouble to be considered except where the grower was almost assured of incorrect returns and the latter proceeding would rarely be adopted except in extreme cases.

At the present time the commission charge generally levied is $7\frac{1}{2}\%$ of gross returns but this does not appear to be definitely fixed and whilst some cases are reported where a higher charge has been made others are noted where the commission is based on quantity sold irrespective of the price realised. This latter practice is particularly unfair since obviously the salesman has no incentive to make a good price but is induced to sell cheaply in order to get as much through his hands as possible. Since the services performed by the commission salesman for the consignor vary from market to market and from salesman to salesman in any one market it would be difficult to standardise the charges made for those services and it is quite probable that some at least of the salesmen take advantage of the existing irregularity when handling the produce of the occasional consignor.

CELERY PRICES.

This section is a brief resumé of those factors that influence variations in price, the reasons for their operation and the methods by which they may be controlled, where control is possible. There are of course many general factors that have an important bearing on prices, such as a rise or fall in the acreage under the crop, good or poor yields, competition on the market with other salad vegetables or the lack of such competition and an increase or decrease in the purchasing power of the consumer: all of which affect the price of celery to some extent, but this section will be devoted to more specific causes of variation.

MONTHLY VARIATION :

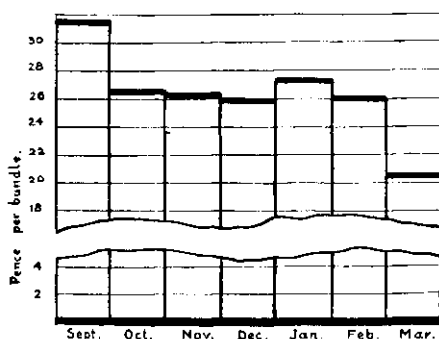
Celery is a definite-season crop. The early white varieties appear on the market about the middle of August and the crop is marketed from then on until the latest and hardiest pinks are sent in towards the end of March or perhaps early April. The early varieties must be lifted before the heavy frosts and the very late and hardy types are not ready much before Christmas, but the main crop, which constitutes

the bulk of the celery, may be disposed of almost any time from mid-September to the end of December or may be held into February if the winter is mild. This means that the main-crop grower is always faced with the problem of when he may most effectively market his crop and although his decision will be influenced by such factors as his immediate need for cash, the condition of his celery and the average yield of the crop in the locality the chief determinant will always be the prices ruling at the moment.

It is generally understood that celery sells well very early and very late in the season and October and November are quoted as months of poor average prices. With a view to getting more definite information on the question of monthly variation, the average prices of second quality celery were taken month by month throughout the season at seven markets, for the ten-year period 1918-28, and plotted. Prices were much higher in September of 1920-21 than in any other month of that season and, generally speaking, September prices appear to have steadily maintained a comparatively favourable position. The October prices were fairly good following the high September figures in 1920-21 but since that season both October and November prices have justified the general opinion that these are months of low prices. The February prices appear to have been the most variable: for the last two seasons plotted they were higher than any other month but on previous occasions they have been comparatively low. January prices, on the other hand have been consistently steady and comparatively good since 1918-19.

GRAPH C.

AVERAGE MONTHLY PRICES OF SECOND QUALITY CELERY FOR THE TEN-YEAR PERIOD 1919-28.



Graph C. however, illustrates far more clearly the relative monthly prices of celery. This graph is based on the average monthly prices of Grade 2 celery at seven markets over the season for a period of ten years. The average of the September prices is outstandingly

higher than that of any other of the months and although this is due in part to the unusual September prices of 1920-21 there is still no doubt that for this month prices generally have been good. The average of the October prices shows a distinct fall, with the November and December averages sinking still lower. After Christmas the average shows a rally in January, which holds into February but gives way to a large decrease in March.

From a careful study of the factors indicated above several general conclusions may be drawn. In the first place it is evident that higher prices in September are due to the fact that the early celery sold at the beginning of the month is in comparatively short supply. A scrutiny of the weekly prices reveals the fact that whilst higher prices are common during the first and second weeks of September they often fall in the third and fourth weeks to the same level as the October prices. The difference between the levels of the average for October, November and December cannot be considered significant. The bulk of the crop is marketed during these three months and numerous minor factors contribute to variations throughout this period. The rising prices after Christmas, as shown by the January average, are probably due to the fact that shortage of supplies is beginning to be felt and rates for good celery tend to harden. The bulk of the well-preserved late celery is now coming on to the market and the poor diseased and frost-damaged produce is held back until the better quality stuff has been cleared. Supplies of first-class celery begin to shorten in February, small, second-rate stuff starts to come on to the market and prices drop. Advancing into March there is very little celery of good quality left and the odds and ends of the season come in, making the average prices for this month much lower than that of any other.

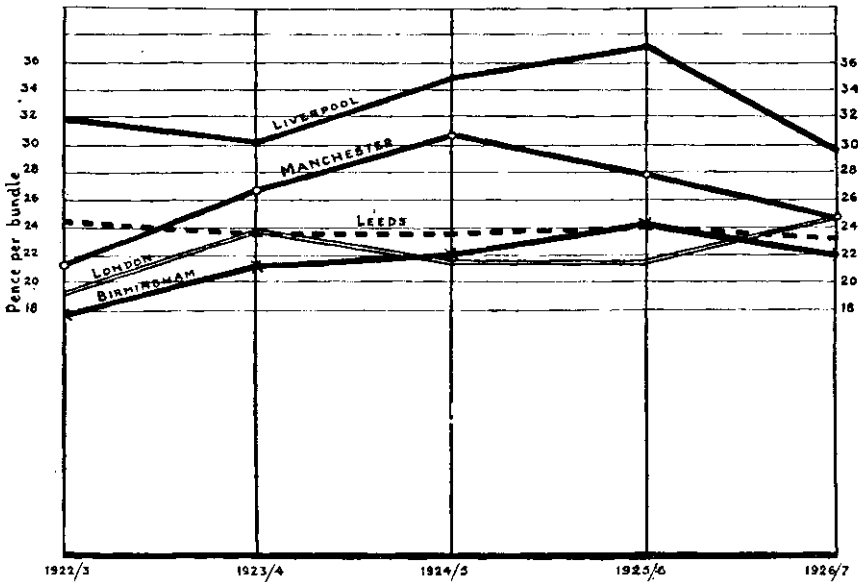
(4)

These conditions indicate that it pays to get on to the early market with good first-class celery, but whilst little is gained by holding good stuff until the end of the season, the grower is more likely to lose than gain by keeping back celery of second quality in the hope of a shortage.

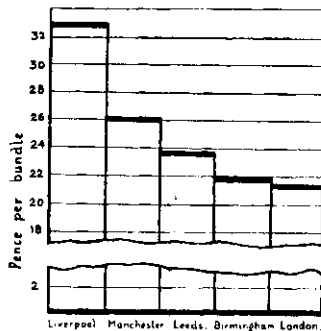
MARKET VARIATIONS.

A casual glance at the wholesale market prices of celery reveals distinct variation in price from market to market on the same date. This is common to many commodities but if the matter is followed further in connection with celery it is found that in this latter case it is far more than incidental variation. Graph D shows this very plainly. On this graph the average annual wholesale prices of first and second-class celery at five markets have been plotted for a period of five years. Birmingham, Leeds, Liverpool, London and Manchester are taken as representative markets and the resulting graph reveals singular differences in the price that has been generally obtainable at any of these centres during the five seasons reviewed. The prices at Liverpool are scarcely approached by those of the other markets, and, as illustrated by Graph E. they maintain an average over the whole period of 6.7d. per dozen more than the nearest rival, which is Manchester. The Manchester annual average prices are consistently

GRAPH D.
SEASONAL AVERAGE CELERY PRICES AT FIVE MARKETS FOR FIVE
YEARS.
(AVERAGE OF FIRST AND SECOND QUALITY).



GRAPH E.
CELERY PRICES AT FIVE MARKETS FOR FIVE YEARS.
(AVERAGE OF FIRST AND SECOND QUALITY).



higher, with the exception of the first year, than any of the other three and they have a period average increase over the third market, Leeds, of 2½d. per dozen. The lowest two markets, Birmingham and London, vary very little and the annual average price is higher at one for a couple of years, and then at the other.

Superficially, it might be expected that celery growers would soon discover the higher range of prices that prevail at Liverpool and Manchester and increasing amounts consigned to these markets would bring down the price to a level corresponding to that ruling at other centres. Enquiry amongst growers in the Axholme area, however, would reveal the fact that these men get similar returns from all these markets and any variations in the prices they receive would appear to be incidental, favouring first one market and then the other. This shows that the value of any particular class of celery varies very little from market to market and leads to the conclusion that Liverpool chiefly, and Manchester to some extent, are supplied by a better type of celery than finds its way into the other markets investigated. This is explained by a brief survey of the position of these markets. Liverpool, in the North-west, is ideally placed to receive the Lancashire and Cheshire celery, and Manchester is the next market that is most available for the Lancashire and Cheshire growers. The celery from these areas is of better quality than that produced in Lincolnshire, it is better packed and usually graded. In the market it always commands the top prices and since the bulk of it goes to Liverpool and Manchester these markets are foremost in the scale of annual average prices.

This is a high testimonial to the advantages of grading and good packing. Although the celery from producing areas in Cheshire and Lancashire is considered of superior quality to that of Lincolnshire and Cambridgeshire there is no doubt that much of the difference lies in the methods of marketing. Grading is practised in Lancashire and Cheshire, the market garden areas around Melbourne in Derbyshire and at other small centres where celery is produced on a market garden scale: it is neglected in the lower Yorkshire area, in Lincolnshire, Nottinghamshire, Cambridgeshire, Huntingdonshire and Norfolk and until growers in these latter centres take steps in the way of grading and packing they will never realise prices for their celery comparable with those commanded by the producer of the first-named areas.

A CELERY GRADING EXPERIMENT.

With a view to obtaining some reliable data on the value of celery grading an experiment was undertaken during the 1928-29 marketing season in the marketing of graded and non-graded supplies. The graded celery was made up in two grades: Grade 1, bundles consisted of 12 selected sticks, large and uniform in size, of first class quality, trimmed, and tied with a distinctive band: Grade 2 consisted of that celery left after the selection of Grade 1, tied with different coloured bands. The ungraded celery which was consigned in quantities equivalent to the graded, came from the approved plots and was exactly similar to the graded celery except that it was trimmed and tied in the ordinary way. The celery was consigned to three selected markets, Sheffield, Leeds and Manchester, according to a pre-arranged loading scheme and the prices realised by the different classes of each consignment were recorded for analysis.

Table B shows the actual number of consignments that were made to each market, the dates, the amount of each grade and the average price received per bundle for each grade. It will be seen from this table that 19 consignments were made to Sheffield market, making a total of 2,062 bundles, of which 714 were Grade 1., 317 Grade 2, and 1,031 ungraded. Similarly 13 consignments went to Leeds, totalling 1,428 bundles, 500 of Grade 1., 214 Grade 2, and 714 ungraded: only 10 consignments however, were made to Manchester, and these comprised 1,738 bundles in all, 488 being Grade 1., 381 Grade 2, and 869 ungraded. Altogether 42 consignments were made and these comprised 1,702 bundles of Grade 1., 912 bundles of Grade 2, and 2,614 bundles of ungraded or 5,228 bundles of celery in all.

The Table also gives for each separate market, the average price per bundle of the different grades of each consignment together with the weighted average price of the graded celery for comparison with the average price of the ungraded. It will be noted that the weighted average price of the graded celery steadily maintained a higher level than the ungraded.

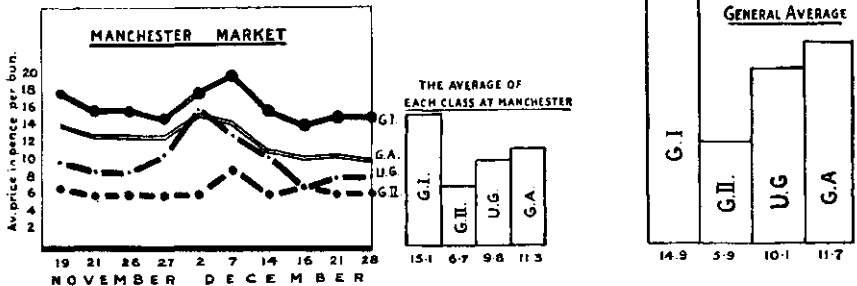
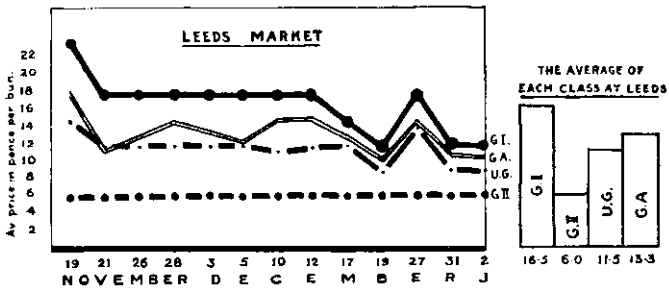
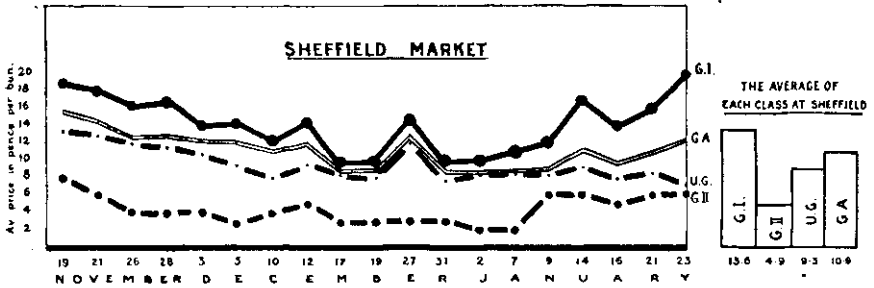
The information set out in the table is also graphically illustrated.* The graphs depict the different average prices realised (in pence per bundle) by each class of celery, consignment by consignment, at each separate average. The weighted average price of the graded celery has been plotted on for comparative purposes. The wide difference between the prices realised for the first and second grades at all markets is immediately obvious, but comparisons between these separate prices and those of ungraded celery are of little value as an index of the cash advantage (to the grader) of grading, since this depends on the proportion of first to second grade in his output. The proportion (*i.e.* number of bundles) of first to second grade was very high at the outset but after a time more rigorous grading was adopted and since the quality of the celery deteriorated towards the end of the season it became lower and lower until in several cases equal quantities of each grade were despatched.

* Page 48.

TABLE B.

DATE.	SHEFFIELD MARKET.							LEEDS MARKET.							MANCHESTER MARKET.						
	Bundles Consigned.			Average Price in Pence per Bundle.				Bundles Consigned.			Average Price in Pence per Bundle.				Bundles Consigned.			Average Price in Pence per Bundle.			
	Grade 1.	Grade 2.	Ungraded.	Grade 1.	Grade 2.	Ungraded.	Graded Av.	Grade 1.	Grade 2.	Ungraded.	Grade 1.	Grade 2.	Ungraded.	Graded Av.	Grade 1.	Grade 2.	Ungraded.	Grade 1.	Grade 2.	Ungraded.	Graded Av.
Nov. 19	25	13	38	19.2	8	13.6	15.7	25	12	37	24.0	6	15.0	18.2	25	13	38	18	7	10	14.2
21	25	10	35	18.0	6	13.3	14.6	20	21	41	18.0	6	12.0	11.9	25	10	35	16	6	9	13.1
26	30	12	42	16.2	4	12.0	12.7	30	20	50	18.0	6	12.0	13.2	30	12	42	16	6	9	13.1
28	30	12	42	17.0	4	11.7	13.3	30	12	42	18.0	6	12.0	14.6	..	..	..	..	..	..	..
Dec. 3	35	8	43	14.1	4	10.7	12.2	35	19	54	18.0	6	12.0	13.8	..	..	..	..	..	..	..
5	35	8	43	14.3	3	9.5	12.2	20	20	40	18.0	6	12.0	12.0	..	..	..	..	..	..	..
10	40	12	52	12.1	4	8.0	11.3	40	12	52	18.0	6	11.5	15.2	..	..	..	..	..	..	..
12	40	12	52	14.4	5	9.6	12.2	40	12	52	18.0	6	11.8	15.2	..	..	..	..	..	..	..
17	60	12	72	9.9	3	8.4	8.7	60	22	82	15.0	6	12.0	12.6	..	..	..	..	..	..	..
19	60	12	72	10.0	3	8.0	8.8	60	22	82	11.8	6	8.8	10.3	..	..	..	..	..	..	..
27	50	12	62	15.0	3	12.0	12.7	50	20	70	18.0	6	14.0	14.6	..	..	..	..	..	..	..
31	..	..	..	..	..	..	..	45	10	55	12.0	6	9.0	10.9	60	16	76	15.2	6	10.7	13.1
Jan. 2	45	10	55	9.9	3	7.7	8.6	..	..	..	..	..	..	..	..	..	..	..	..	..	..
7	45	12	57	10.0	2	8.2	8.3	45	12	57	12.0	6	9.0	10.7	45	10	55	18	6	16	15.8
8	34	12	46	10.9	2	8.3	8.6	..	..	..	..	..	..	..	60	60	120	20	9	13	14.5
14	40	40	80	12.0	6	8.3	9.0	..	..	..	..	..	..	..	..	..	..	..	..	..	..
16	30	30	60	17.0	6	9.4	11.5	..	..	..	..	..	..	..	60	60	120	16	6	10.5	11.0
21	30	30	60	14.0	5.2	7.9	9.6	..	..	..	..	..	..	..	60	60	120	14	7	7.0	10.5
26	30	30	60	16.0	6	8.4	11.0	..	..	..	..	..	..	..	60	60	120	15	6	8.0	10.5
23	30	30	60	18.0	6	7.3	12.0	..	..	..	..	..	..	..	..	..	..	..	..	..	..
28	..	..	..	..	..	..	..	..	..	..	..	..	..	..	63	80	143	15	6	8.0	10.0

COMPARISON OF PRICES REALISED BY SIMULTANEOUS CONSIGNMENTS OF GRADED AND UNGRADED CELERY AT THREE SEPARATE MARKETS.



KEY: G. I. = GRADE I.
 G. II. = GRADE II.
 U.G. = UNGRADED.
 G.A. = GRADED AVERAGE.

From the point of view of this experiment the most valuable comparison is that between the average price of ungraded and the weighted averages of first and second grade. *Market by market and consignment by consignment, graded celery realised more per acre than ungraded.* Out of 37 consignments made, only on two occasions did the ungraded celery realise more per bundle than the weighted average of the graded.

At the Manchester and Sheffield markets the widening of the margin that occurs towards the end of the season between the price of ungraded and the graded average is particularly apparent. This is probably due to the fact that the celery was of very poor quality and grading and tying in regular bundles improved the appearance far more than was the case earlier in the season.

The bar diagram* for each market emphasises the general conclusions drawn. The arithmetic mean of the prices realised per bundle of all the bundles in each class is here illustrated and this demonstrates very effectively that graded celery realised more per bundle than ungraded at all markets.

For the purposes of the experiment the produce of approximately $3\frac{1}{2}$ acres was taken. The crop was comparatively good and the sticks were perhaps more uniform than is commonly the case: no "Blight" damage was reported and the proportion of second to first class celery was lower at the beginning of the season than is general. The following table summarises the number of consignments made and the average price realised per bundle by the different classes of celery.

TABLE C.

Market.	Class of Celery.	No. of Bundles.	Total Price Realised.	Average Price Per Bundle.
SHEFFIELD ..	Grade 1.	714	£ 40 7 0	d. 13.56
	Grade 2.	317	6 8 10	4.87
	Ungraded.	1,031	40 0 3	9.31
LEEDS ..	Grade 1.	500	34 6 6	16.47
	Grade 2.	214	5 7 0	6.00
	Ungraded.	714	34 2 0	11.46
MANCHESTER ..	Grade 1.	488	30 12 9	15.10
	Grade 2.	381	10 11 7	6.66
	Ungraded.	869	35.10 10	9.82

* See page 48.

Below are collected the total number of bundles of each class and the weighted average price per bundle of those classes at all markets :—

TABLE D.

Market.	GRADE 1.			GRADE 2.			UNGRADED.		
	No. of Bundles	Returns.	Average per Bundle.	No. of Bundles	Returns.	Average per Bundle.	No. of Bundles	Returns.	Average per Bundle.
		£ s. d.	Pence.		£ s. d.	Pence.		£ s. d.	Pence.
SHEFFIELD ..	714	40 7 0	13·56	317	6 8 10	4·87	1,031	40 0 3	9·31
LEEDS ..	500	34 6 6	16·47	214	5 7 0	6·00	714	34 2 0	11·46
MANCHESTER ..	488	30 12 9	15·10	381	10·11 7	6·66	869	35 10 10	9·82
	1,702	£105 6 3	14·85	912	£22 7 5	5·89	2,614	£109 13 1	10·08

The weighted averages of the different classes are extracted and that of the graded bundles added for comparison :—

Grade 1.	Grade 2.	Ungraded.	Graded Average.
14·85	5·89	10·08	11·73

It is of course the difference between the weighted average of the ungraded and that of the graded bundles that proves the success of the experiment. The difference obtained by this general analysis, 1.65d. per bundle, is exceptionally good and conclusive evidence of the value of grading.

COST OF GRADING.

Lifting in the ordinary way is undertaken at piecework rates and the workmen on the selected farms were prepared to grade if remunerated for the extra labour entailed. This was accordingly settled on a basis agreed between the foreman and the pieceworkers. The amounts paid together with the other expenses incident to the grading are set out below. It should be pointed out here that although the produce of about $3\frac{1}{2}$ acres was consigned for the purposes of the experiment only one half of this (2,614 bundles) was graded.

TABLE E.

GRADING EXPENSES ON 2,614 BUNDLES OF CELERY.

Extra Labour Costs for Grading	..	..	..	£	s.	d.
Stringing and Tying on labels	..	..	..	2	3	9
Band for labels	..	..	..	..	13	1
Band for labels	..	..	..	..	2	0
1½ rolls of coloured tape	..	..	..	..	9	0
1½ bundles of tape	..	..	..	..	3	9
3,000 coloured labels	..	..	..	..	15	4
Total	..	..	..	£4	6	11

These expenses constitute a charge of approximately 0.395d. per bundle for grading, which would become about 50/- per acre on an average crop of 1,500 bundles.

THE GRADING MARGIN.

Correlating the above figures with those representing the increased returns due to grading it will be seen that the grader working under similar conditions to those under which the experiment was undertaken in the season 1928-29 would have benefited to the extent of

approximately 1.25d. per bundle. Such a return, under average crop conditions in a like season is equivalent to a grading margin of £7 16s. 3d. per acre.

GRADED CELERY AT THE MARKETS.

When the experiment was completed the views of the salesmen who had handled the graded celery at the different markets were elicited and the following general conclusions were reached :—

(1). Lincolnshire celery is of comparatively poor quality and the general inferiority is aggravated by the common practice of tying the poorer sticks in the middles of the bundles. Owing to this practice buyers at first doubted the constancy of the grading but after the first few consignments they gained confidence and a definite demand for graded Isle of Axholme celery was established.

(2). The grading was not sufficiently rigorous: the first grade Lincolnshire celery was no better than second grade Lancashire and if celery from the Isle is to compete with local produce on the Manchester market, at least, a much higher standard will be necessary.

(3). Finally, it can definitely be stated that these three markets have an outlet for graded celery and once the grades are standardised with a sharp division between first and second quality the demand for Lincolnshire celery will undoubtedly increase and prices for this class of celery should maintain a higher level.

THE EXPENSES AND RETURNS OF CELERY GROWING IN THE ISLE OF AXHOLME.

In connection with this investigation complete records of operations and cash expenditure on the celery crop were obtained from thirty holdings of diversified types. Fairly wide deviation in certain item costs were noted from holding to holding but it is considered that the sample was large enough to allow some generalisations to be made. Average figures for the various items of expenditure were calculated on the whole of the celery acreage under consideration and these together constitute the following table, from which the general average allowance for manurial residues has been deducted in order to arrive at a figure for nett expenses.

TABLE F.
AVERAGE PER ACRE EXPENSES OF CELERY GROWING.

					£	s.	d.
*Total Labour Expenses	..	..	..	..	19	6	0
Cost of Plants	..	..	..	..	4	19	0
Manures : Farmyard Manure	..	..	..	..	12	1	0
Artificials	..	..	..	..	1	14	0
Overhead Charges	..	..	..	..	3	2	0
Sundry Expenses	..	..	..	..	2	2	0
					43	4	0
Less Residual Value of Manures	..	..	..	..	6	11	0
					£36	13	0

* The average of the total labour expenses on those farms where plants were purchased.

Table F. shows the gross expenses incurred on the crop but before calculating each item as a percentage expense it is essential to deduct manurial residues from the cost of manures. The table, with calculated percentages, is then modified as follows:—

TABLE G.

					£	s.	d.	
Total Labour Expenses	..	..	..	..	19	6	0	52.7%
Cost of Plants	..	..	..	..	4	19	0	13.5%
Manures : Farmyard Manure	..	..	..	..	6	0	6	16.4%
Artificials	..	..	..	..	1	3	6	3.2%
Overhead Charges	..	..	..	..	3	2	0	8.5%
Sundry Expenses	..	..	..	..	2	2	0	5.7%
					£36	13	0	100.0

A few words in explanation of each item in this table may be of value. Before discussing the labour expenses, however, the footnote to Table F. must be explained. The holdings from which expenses

have been collected may be classified into two groups: those raising their own seedlings and those purchasing, and it has been decided in setting out this analysis to include cost of plants as purchased. This course means that the general average figure for labour cannot be utilised since in those cases where plants were raised on the holding the expense of growing the seedlings is included in the total labour expenses. To overcome this difficulty, therefore, the total labour expenses shown in these tables is really the average of those expenses on the holdings where plants were purchased. It is of passing interest to note that this figure is actually slightly higher than the corresponding figure on holdings raising plants.

LABOUR EXPENSES.

The total labour expenses include all labour expenses on the crop up to putting on the rail; *i.e.*, regular manual labour, piece-work and horse labour. The piece-work has been recorded by the actual cash payments whilst regular labour has been recorded in hours and charged up at the rate of 8d. per hour for manual labour and 6d. per hour each for women, boy and horse labour. Sixpence an hour may appear high for horse labour but the high overhead charges make horse keep expensive and in the few cases where horses were hired by smallholders the rates were exceptionally heavy.

Labour costs constituted more than 50% of the nett expenses of growing the crop and over £19 per acre spent on labour alone may seem high in comparison with other arable crops. It must be remembered, however, that celery is a market garden rather than a farm crop and the returns that may be expected in a successful year are sufficient compensation for the unusual expenditure in attention. Of course the labour expenses of the different holdings varied a good deal round the general average and it should be noted that in a periodic frequency table of labour expenses with intervals of £2 there are more holdings in the £16—£18 group than in any other.

COST OF PLANTS.

Cost of plants is included in Table G, since it is considered that a better analytic view of the expenses is obtained in this way than would be the case were the plants accepted as raised on the farm and the expense of raising included in the charge for labour. About 21,000 plants are required to plant an acre so it would appear that the average cost of plants has been approximately 4/9 per thousand. The price of plants naturally varies a good deal from season to season and at different times throughout each, but, generally speaking, 5/- per thousand for good strong plants was considered a very fair price at the time of the investigation. It has already been noted that those holdings raising seedlings did so without greatly increasing their labour bill, and further analysis of records shows that total average costs of raising these plants and taking them up ready to plant in the field was approximately £2 per acre. From this it becomes obvious that a definite saving in expenditure is made by the grower who produces his own plants but to offset this it must be remembered that there is always the risk of seed-bed failures.

MANURING EXPENSES.

In Table F, the complete average expenses of manuring are given whereas in Table G, an allowance for the residual value of the manure has been made. A few words, therefore, on the basis on which the deduction for residual value was made will be relevant here.

Celery is followed in the rotation by potatoes, after which two white crops are taken and then seeds. The application of farmyard manure to the celery crop varies from 15 to 30 tons per acre and the average dressing is round about 25 tons per acre, no farmyard manure is applied to any of the other crops following, but the potatoes generally receive a good dressing of artificials. Since it is the custom to apply 10—15 tons of farmyard manure to the potato crop when this crop is not preceded by celery it may be argued that the heavy dressing of farmyard manure is applied to the latter with the object of manuring that crop and the following and that the potato crop therefore, is really benefiting to the extent of 10 tons per acre or so. Hence from this point of view there are good grounds for the assumption that approximately half the manurial application will go to benefit following crops. Such an assumption however, is based on practical consideration only and requires some scientific justification. This is obtained through a consideration of the rates of availability of the fertilising constituents and of the nitrogen in particular. It is well-known that this rate is very slow and that the value of the farmyard manure is spread over a number of years: but it is also recognised that in the first year more is available than in the second, more in the second than the third, and so on. Hence by applying all the manure to the first crop instead of spreading it over the rotation the earlier crops get a larger proportion of fertilising constituents at their disposal than would otherwise be the case. It may be assumed therefore that although the farmyard manure is applied with the definite intention of manuring the whole rotation one half of the cost of the application is chargeable to the celery crop and the residual values have been apportioned on this basis.

The residual value of artificials applied has been fixed on the basis of Hall and Vœlcker's Tables. Where a compound dressing has been used and information as to its composition has not been available two thirds of the cost has been charged to the celery.

In Table G even after the value of residuals has been deducted, the expenses on manuring are high and some explanation of the method of arriving at the figures given appears to be necessary. In a previous section of the report it has been pointed out that many of the celery growers are unable to produce sufficient manure on their holdings for the cropping requirements and the result is that manure is purchased from large towns in the neighbourhood of the Isle. The falling off in city horse traffic during recent years has given rise to a scarcity of this manure with corresponding price increase. Costing four or five shillings at the source the expense of town manure is practically doubled by carriage and it costs about 9/- per ton on the field. Since some of this manure is very inferior to good farmyard manure the latter may at least be charged to the crop at the same price and this is the method that has been adopted.

So far as the expenses on artificials are concerned the figures used in the Tables merely represent the weighted average of the total expenditure on artificials on the acreage under review and since several growers applied no artificials at all little discussion centres round the figures shown. With artificials at present prices a gross expenditure of about 50/- per acre would give the dressings recommended under the section on manuring.

OVERHEAD CHARGES.

The overhead charges include rent and rates, a charge for hedging and ditching and for implement depreciation and general overhead expenses. Rental variations are wide and this item ranges from 30/- to £4 per acre, which gives some idea of the diverse types of soil on which the crop is grown in this area. It is only fair to add, however, that the majority of growers pay nearer to £3 than to 30/- per acre for the use of their land.

SUNDRY EXPENSES.

The sundry expenses include such items as the cost of spraying material, willows and band for tying, etc. The average figure quoted in the tables is rather lower than might be expected on a well-managed holding as several of the recording growers might have increased their expenditure on spraying with advantage and there were some who failed to spray at all. Excluding the cost of labour, an acre of celery can be sprayed eight times at an expense of approximately £1. If to this amount is added an average figure of 30/- for willows and band the amount quoted in the tables is already exceeded.

SUMMARY OF EXPENSES.

The average nett expense of £36 13s. od. per acre is slightly higher than need be incurred on a good holding carefully managed. No reduction on the amount spent on labour is suggested as desirable since although the amount of £19 6s. od. was somewhat higher than the labour expense on the majority of holdings yet it must be remembered that celery is a crop that responds readily to attention bestowed upon it and money carefully expended in its cultivation is usually well justified. The expenditure of approximately £5 on young plants has been shown to be quite unnecessary, however, and growers should remember that, generally speaking, they are cutting down expenses by raising seedlings. In returning once more to the question of manuring it may be remarked that this is an item in which economies might be effected on many holdings. It is suggested in the first place that the average dressing of 25 tons of farmyard manure per acre is heavier than is necessary to produce a good crop and in many cases this might be reduced to 20 or even 15 tons per acre without adversely affecting the yield. The peat land in particular, ought to produce good crops of celery without such a heavy application of farmyard manure and the possibility of economically and successfully making a partial substitution with the organic fertilisers such as shoddy or guano, is again recommended for attention. The average expense on artificials is low and would be increased by a good cultivator : overhead

charges are not directly controlled by the grower and as already explained, the sundry expenses would tend to be higher on a well-managed holding.

RETURNS.

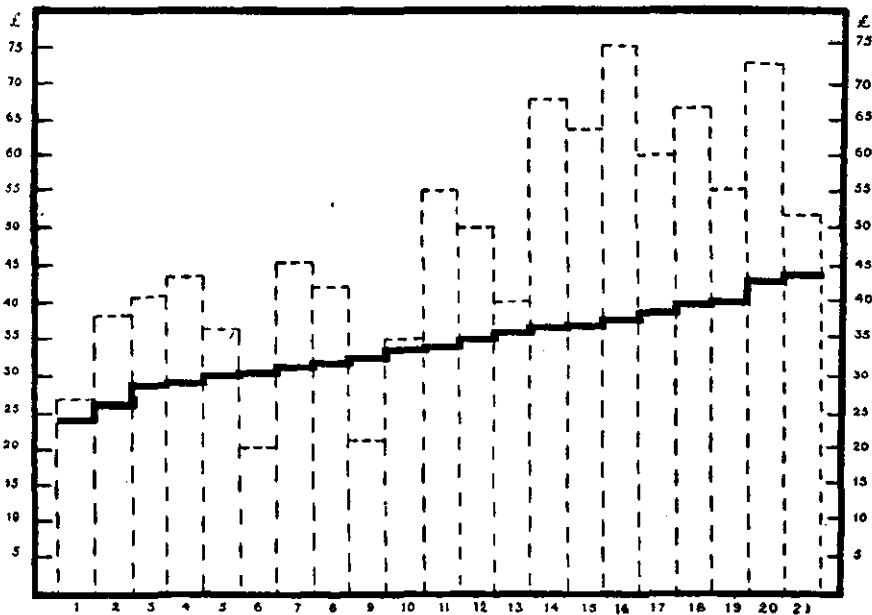
Generally speaking the 1927-28 celery crop in the Isle of Axholme was a paying proposition. Out of the thirty growers sending in returns only four recorded losses. Three of these were mainly due to attacks of Blight and damage by frost (although bad management was a contributory cause in one instance) and the fourth occurred where the farmer grew at half-part under an agreement whereby he received a fixed sum irrespective of the amount realised by the crop. In this latter case there was an excellent crop but the farmer did not participate in the returns and the amount he received actually failed to compensate him for his expenses. Such a scheme is a measure of insurance to the farmer against dead loss in the case of crop failure, but he is adversely affected by a heavy yield since this only means more expenditure in carting. He ought in any case to stipulate for remuneration that will compensate him for his outlay. The method may be advantageous to the farmer who is without experience in celery growing but otherwise it has nothing to recommend it.

Graph F. has been constructed to illustrate the relation between nett expenditure and returns. All holdings where either expenses or returns have been strongly influenced by unusual circumstances peculiar to the holding or by factors not of general application have been omitted and the remaining sample have been plotted as giving a fair indication of the general trend. The holdings are arranged in order of increasing expenditure on the crop and the returns are plotted on this basis. All the figures are per acre. It would be unwise to offer more than generalisations on the results of one year's crop on a score of farms but the increase in returns for rising expenditure, particularly after an expense of about £34, is very marked. This emphasises the general assumption that the crop pays well for careful attention and adequate manuring. It is interesting to note too, that the poorest returns occurred not at the lowest expenditure but during the moderate interval between £30-£34. Both cases recording a deficit occurred in this latter group.

The percentage return on outlay is shown in Graph G, and the holdings are classified into four groups to give some indication of the expenditure bringing the highest percentage return. To construct this Graph the percentage return on each holding in Graph F. has been calculated: these have been grouped into classes with £5 intervals, commencing at £25. The average of all the holdings in each class has been taken as representative of the particular group from which it was derived and Graph G. has been constructed from these figures. The resulting graph illustrates more clearly, and classifies the differences noted in Graph F.

GRAPH F.

COMPARISON OF PER ACRE EXPENSES AND RETURNS OF 21 CELERY GROWING HOLDINGS ARRANGED IN RISING ORDER OF EXPENDITURE.



GRAPH G.

PERCENTAGE RETURN ON CAPITAL OUTLAY.
[FREQUENCY GROUPING OF GRAPH F.]



On those holdings examined, therefore, it would appear that a nett outlay of £35—£40 brought in the best returns. Although there are not sufficient cases upon which to dogmatise it is probable that increases in yield for expenditure over £40 are small and the law of diminishing returns becomes operative. The second group, containing those holdings with an expenditure of £30—£35, gave the lowest average percentage return. This may be regarded as somewhat abnormal and is attributed in part to the fact that both those holdings showing a deficit are included in this group. The £25—£30 group have a good percentage return, due to the fact that average returns resulted after economies in production.

Generally speaking these results indicate that it is false economy to diminish expenses on celery growing to below a nett amount of £35 per acre but many growers are producing at lower expenses. The figures used throughout this section as growers' returns are the actual cash returns received by the grower and although they have been accepted during this discussion as a rough measure of yield it must be remembered that factors external to the bulk and value of the crop, *i.e.*, market fluctuations or the bargaining power of the grower, influence these figures to a varying extent.

CONCLUSIONS.

Speaking of agriculture generally it is true to say that progress has been far more rapid in the productive than in the marketing side of the industry. This country has been and still is the pioneer in the application of new methods of farming practice and is an example to all others in crop and animal husbandry. Unfortunately however, the same cannot be said of the marketing methods of the British farmer: although progress is certainly being made he still lags behind his overseas competitors in this respect with the result that he does not enjoy, to the extent he should, the fruits of his labour in the field of production. A brief review of the existing conditions of celery production and marketing in the Isle of Axholme as revealed by this survey, indicates that there is plenty of scope for improvement in both phases of the industry. The standard of production, however, is far more advanced than that of marketing and there is a definite and immediate need for more co-ordination and centralisation in the disposal of the crop.

Celery is dealt with in varying quantities in practically every important fruit and vegetable market in this country. In most cases however, the section of a market or the proportion of a dealer's time devoted to celery is comparatively small, and, generally speaking, the value of the celery trade in the average market would indicate that it is not of primary importance. This may be attributed in part to the fact that in the condition in which it is marketed at the present time celery has small bulk value and does not give such returns on handling as do more expensive and less bulky commodities. Furthermore the demand for celery is at present comparatively elastic and a sudden shortening of supply will not give the phenomenal price rise characteristic of some fruits and vegetables under similar circumstances. Compared with the trade in the United States and in many Continental countries, the retail celery trade in this country is very undeveloped and its expansion might confidently be expected with improved methods of wholesale marketing, and particularly with some improvement in the condition of the celery brought on to the market. If, together with such improvements, marketing costs could be effectively reduced it would be considerably to the advantage of the industry and a brief examination of the possibility of narrowing the working margin of some or all the intermediaries may be of value. A simple case may be assumed in which these consist of the transporting agent, the market agent and the retailer.

Although motor lorries are becoming an increasingly popular method of transport by far the bulk of the celery is railed from grower to market. Since this investigation was undertaken freight rates for many classes of agricultural produce have been reduced but the rates for celery have not been included in this revision. Some reduction of present rates would certainly improve the situation. The position of the market agent in celery distribution has been discussed earlier: from the available evidence it would appear that where the celery passes through the hands of a wholesaler his margin is not altogether

unreasonable and that there is sufficient competition within the trade to keep down the cost of his services to a fair level. The possibility therefore, of reducing the wholesaler's margin to lessen the price to the consumer is somewhat remote. Where the first intermediary is a commission salesman improvements might be effected in some instances, but these minor readjustments would affect the eventual market price of the celery very little. As with all commodities the greater part of the "spread" between producers' and consumers' prices occurs from the passing of the celery into the hands of the retailer. There may be several reasons for the wide margin the retailer insists upon but it is suggested that the chief cause is found in the condition in which celery is marketed at the present time. The retail price generally places it within the reach of all classes but there is little doubt that more would be consumed if prices were lower. Further, judging from the opinions expressed both by the wholesalers and the retailers consumption would be appreciably increased if the celery was offered in a more attractive form. Hence it follows that marked improvement in the condition in which celery leaves the farm would not only tend to lessen the spread between the producers' and consumers' prices but would probably have the additional advantage of stimulating demand.

Celery is raised by the grower in a very rough condition ; unwashed and with the foliage practically untrimmed ; in fact, except for the pulling off of a few withered or injured leaves it is literally bundled up just as it grows in the field and consigned immediately to market. With the exception of very few instances, and these generally where the bundles are in a particularly rough and dirty condition, the wholesaler does no trimming and the retailer is forced to handle a good deal of unsaleable material. Very often he must wash the celery as well as trim it with the result that he regards the bulky and dirty bundles of celery with disfavour. Furthermore, most of the celery is marketed in an ungraded condition : the bundles consist of large sticks on the outside and small ones in the middle and the retailer with a first-class trade is forced to purchase a large amount of inferior celery which he finds difficult to sell. On the other hand the hawkers and barrow-men trading in the streets want the cheaper celery and are not inclined to pay more for better stuff. Thus the grower loses every time through not grading his produce ; the better-class buyer expects deceptive bundles and makes allowance for them and the hawker refuses to pay more for the first-class celery which he gets mixed with inferior. Hence, whilst improvement in the general condition in which the crop is marketed is absolutely essential, some form of standardisation of grading and bundling is equally important.

It has been shown by actual experiment in the Isle of Axholme* that grading is both practicable and profitable and growers are recommended without reservation to grade their crop. Two grades are suggested and the grades should be sharply defined and closely maintained. Whatever method of grading is adopted, however, it should not vary from grower to grower and the best means of standardising the practice would be through the medium of some form

* p.p. 46—52.

of growers' organisation. The definition of grades for adoption by such an organisation and by growers generally throughout the country will, no doubt, be taken in hand by the Markets Division of the Ministry of Agriculture and Fisheries, the grades being promulgated in due course under the Agricultural Produce (Grading and Marking) Act, 1928.

Very closely involved with the preceding are the methods of packing employed. At the present time the celery is tied in "square" bundles of twelve or more sticks, the number usually depending on the regularity or otherwise of the crop. If these bundles are well packed and tied the celery may reach the retailer in good condition but so much of the tying is done by piece, with consequent hasty work that many of the bundles are loose and shapeless before they reach the retailer and the celery necessarily suffers a great deal of damage. Again under the present system, the rough leaves are left on the plant and carriage and handling charges are incurred which might be avoided. These packing difficulties could be overcome by consigning in crates. The rough foliage that is left on the celery as a measure of protection would then be removed and carriage saved on this useless material. Grading into different types of crates could be easily effected and the grades would be immediately distinguishable. The difficulties of crating would be the initial expense of crates, cost of upkeep and renewal, increased railway charges, storage space for empties and the problem of collecting and returning. Furthermore the long and bulky celery produced in this country does not lend itself as easily to crating as the shorter-stemmed celery grown in the United States. So far as the first-mentioned difficulties are concerned these are inevitable and must be accepted as part of such a scheme but the success of the system in America and its use for many kinds of fruit and vegetables in this country indicate that these disadvantages are more than compensated. The final objection would lose force if the grower produced shorter celery of better quality. Too much attention has in the past been devoted to the length, weight and showy characteristics of the stick whilst important features like easy bleaching properties, crispness of stem and sweetness of flavour have received very little attention. If the grower adapted his methods to meet the modern demand for quality rather than quantity he would soon be producing a type of celery that could be crated without difficulty.

The attention of growers has recently been drawn to an experiment in washing and wrapping celery for the market. The scheme was undertaken by Mr. Murray, Horticultural Organiser for Lindsey, and consists in trimming and washing each separate stick so that it is in a condition approximating to the state in which it may appear on the table of the consumer. These dressed sticks are then individually wrapped in specially prepared paper and packed in small crates. The scheme is dependent on the keeping quality of the wrapped celery. It has however, proved quite successful on an experimental basis and it is anticipated that as a result of this work an effort will be made to test the process as a commercial proposition. The fact that the proposal to put the scheme on a commercial basis has the financial support of a number of celery growers indicates clearly that the growers

in the Isle of Axholme are not satisfied with their present methods of marketing.

Any form of organisation for improved marketing should be encouraged. It is however suggested that a co-operative effort on the part of the producers to be successful must have a clear appreciation of the services to be rendered, and the added responsibilities which will be incurred by every grower in the organisation should be definitely realised. This survey has shown that weaknesses do exist in the present marketing services which can undoubtedly be corrected by associated action, but unless the growers are prepared to be loyal to their organisation it will not be in a position to perform the marketing services better or even as well as existing agencies.

In conclusion it may be pointed out that celery is a commodity produced extensively only in a few well-defined areas and there is no immediate prospect that new areas of production will be opened up. In view of this localisation the organisation for better marketing should be comparatively easy. Many of the factors such as competing areas both at home and abroad, diversity of farming systems, lack of uniformity in the product and so on, which in the past have been instrumental in deterring the growth of farmers' marketing organisations are not operative to anything like the same extent.

SUMMARY.

For those whose object it is to refer to any one particular phase of the industry dealt with in this report, the following summary is given. Sections and sub-sections are dealt with in relevant order.

PRODUCTION.

Soil and Climate : Celery produced on warp, sand and gravel, Blown Sand, peat and Trent-side alluvium : an adequate supply of soil moisture and effective drainage essential : variations according to soil type. Optimum climatic conditions : different effect of deviations from the normal on the crop on varying types of soil.

Celery Growing in the Isle of Axholme : A localised industry : production increasing in the area in common with the general rise : acreage lapses in other producing areas not paralleled in the Isle and this attributable to types of producers located in the latter district.

Types of Celery Growing Holdings : Holdings classified into three main types and the activities of the growers in each class discussed. "Half-part" growing described.

Rotation : The cropping of the holdings with notes on inter-cropping.

Manuring : The present system discussed ; artificials recommended. The heavy cost of manuring as influenced by the purchase of town "stable" manure and the possibility of affecting economies by partial substitution.

Preliminary Cultivations : General notes on the preparation of the field.

Growing the Seedlings : Preparation of frames and sowing of seed. Causes of seed-bed failures. Bedding out : preparation of the beds and value of the process.

Planting in the Field : Conditions suitable for planting : the planting process : washing the plant roots : seedlings from different classes of soil : "gapping".

Crop Cultivations : Checking weeds : "Blight" control : earthing up the celery : methods of bleaching : earth, boards, heavy paper rolls, individual paper bands and farm drainpipes.

Lifting : The stage at which lifting commences : lifting, trimming and tying. Pitting in the field : carting to station and methods of packing in the waggon. Precautions in frosty weather.

MARKETING.

Factors Governing Choice of Market : The quality of the crop and its influence on destination : proximity to large towns : custom : and price.

Methods of Disposal: Two main channels: (a) sale to local dealer; (b) sale in distant markets. Direct marketing may be either through local dealer on commission, direct to market commission agent or outright sale to wholesaler.

Advantages and Disadvantages of Systems Outlined: The functions of the local dealer—his value to the smallholder. Unsatisfactory aspects of the commission system: current rates and charges.

Celery Prices: Monthly variation—an analysis of long-term fluctuations: general indications. Market variations—steady difference in prices at five markets—the influence of locality: advantages of grading and good packing.

A Celery Grading Experiment: Method and results of a recent experiment on celery grading in the Isle of Axholme: the returns for grading: expenses of the process—the grading margin. Graded celery at the markets.

EXPENSES AND RETURNS OF CELERY GROWING IN THE ISLE OF AXHOLME.

Expenses: Records of operations and cash expenditure: general analysis of expenses with calculated percentages. Labour expenses—cost of plants—manuring expenses and the basis of the value of residuals—overhead charges and sundries. Summary of expenses and critical remarks.

Returns: Celery a paying crop in 1927-28: the relation between expenditure and returns: percentage return on outlay: frequency grouping according to outlay: general remarks.

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