Intensive Cultivation.*

By PROF. FREDERICK KEEBLE, C.B.E., Sc.D., F.R.S.

I PROPOSE to devote my address entirely to horticulture—to speak of its performance during the war and of its immediate prospects. Although that which intensive cultivators accomplished during the war is small in comparison with the great work performed by British agriculturists, nevertheless it is in itself by no means inconsiderable, and is, moreover, significant, and deserves a brief record. That work may have turned, and probably did turn, the scale between scarcity and sufficiency; for, as I am informed, a difference of 10 per cent. in food supplies is enough to convert plenty into dearth. Seen from this point of view, the war-work accomplished by the professional horticulturist—the nurseryman, the florist, the glasshouse cultivator, the fruit-grower and market gardener—and by the professional and amateur gardener and allotment holder assumes a real importance, albeit the sum total of the acres they cultivated is but a fraction of the land which agriculturists put under the plough. As a set-off against the relative smallness of the acreage brought under intensive cultivation for food purposes during the war, it is to be remembered that the yields per acre obtained by intensive cultivators are remarkably high.

The reduction of the acreage under soft fruits—strawberries, raspberries, currants, and gooseberries—which took place during the war gives some measure of the sacrifices—partly voluntary, partly involuntary—made by fruit-growers to the cause of war-food production. The total area under soft fruits was 55,560 acres in 1913, by 1918 it had become 42,415—a decrease of 13,145 acres, or about 24 per cent. But though the public lost in one direction it gained in another, and the reduction of the soft-fruit acreage meant—reckoned in terms of potatoes—an augmentation of supplies to the extent of more than 100,000 tons. Equally notable was the contribution to food production made by the florists and nurserymen in response to our appeals. An indication of their effort is supplied by figures which, as president of the British Florists' Federation, Mr. George Munro—whose invaluable work for food production deserves public recognition—caused to be collected. They relate to the amount of food production undertaken by 100 leading florists and nurserymen. These men put 1075 acres, out of a total of 1775 acres used previously for flower-growing, to the purpose of food production, and they put 142 acres of glass out of a total of 218 acres to like use. I compute that their contribution amounted to considerably more than 12,000 tons of potatoes and 5000 tons of tomatoes.

In this connection the yields of potatoes secured by Germany and this country during the war period are worthy of scrutiny. The pre-war averages were: Germany 42,450,000 tons, United Kingdom 6,950,000 tons; and the figures for 1914 were Germany 41,850,000 tons, United Kingdom 7,476,000 tons. Germany's supreme effort was made in 1915 with a yield of 49,570,000 tons, or about 17 per cent. above the average. In that year our improvement was only half as good as that of Germany, our crop of 7,540,000 tons bettering our average by only 8 per cent. In 1916 weather played havoc with the crops in both countries, but Germany suffered most. The yield fell to 20,550,000 tons, a decrease of more than 50 per cent., whilst our yield was down to 5,469,000 tons, a falling off of only 20 per cent. In the following year Germany could produce no more than 39,500,000 tons, or a 90 per cent. crop, whereas the United Kingdom raised 8,604,000 tons, or about 24 per cent. better than the average. Finally, whereas with respect to the 1918 crop in Germany no figures are available, those for the United Kingdom indicate that the 1917 crop actually exceeded that of 1918. There is much food for thought in these figures, but my immediate purpose in citing them is to claim that of the million and three-quarter tons increase in 1917 and 1918 a goodly proportion must be put to the credit of the intensive cultivator.

I regret that no statistics are available to illustrate the war-time food production by professional and amateur gardeners. That it was great I know, but how great I am unable to say. This, however, I can state: that from the day before the outbreak of hostilities, when, with the late secretary of the Royal Horticultural Society, I started the intensive food-production campaign by urging publicly the autumn sowing of vegetables—a practice both then and now insufficiently followed—the amateur and professional gardeners addressed themselves to the work of producing food with remarkable energy and success. No less remarkable and successful was the work of the old and new allotment holders, so much so indeed that at the time of the armistice there were nearly a million and a half allotment holders cultivating upwards of 125,000 acres of land—an allotment for every five households in England and Wales. It is a pathetic commentary on the Peace that Vienna should find itself obliged to do now what was done here during the war, namely, convert its parks and open spaces into allotments in order to supplement a meagre food-supply.

This brief review of war-time intensive cultivation would be incomplete were it to contain no reference to intensive cultivation by the armies at home and abroad. In 1918 the armies at home cultivated 5869 acres of vegetables. In the summer of that year the camp and other gardens of our armies in France were producing 100 tons of vegetables a day. These gardens yielded in 1918 14,000 tons of vegetables, worth, according to my estimate, a quarter of a million pounds sterling, but worth infinitely more if measured in terms of benefit to the health of the troops.

As the result of Gen. Maude's initiative, the Forces in Mesopotamia became great gardeners, and in 1918 produced 800 tons of vegetables, apart altogether from the large cultivations carried out by his Majesty's Forces in that wonderfully fertile land. In the same year the Forces at Salonika had about 7000 acres under agricultural and horticultural crops, and raised produce which effected a saving of more than 50,000 shipping tons.

Even from this brief record it will, I believe, be conceded that intensive cultivation played a useful and significant part in the war. What, it may be asked, is the part which it is destined to play in the future? So far as I am able to learn, there exist in this country two schools of thought or opinion on the subject of the prospects of intensive cultivation, the optimistic and the pessimistic schools. The former sees visions of large communities of small cultivators colonising the countryside of England, increasing and multiplying both production and themselves, a numerous, prosperous, and happy people and

* From the opening address of the President of Section M (Agriculture) delivered at the Cardiff meeting of the British Association on August 24.

a sure shield in time of war against the menace of submarines and starvation. Those, on the other hand, who take the pessimistic view point to the many examples of smallholders who "plough with pain their native lea and reap the labour of their hands" with remarkably small profit to themselves or to the community.

Before making any attempt to estimate the worth of these rival opinions, it may be observed that the war has brought a large reinforcement of strength to the ranks of the optimists. A contrast of personal experiences illustrates this fact. When in the early days of the war I felt it my duty to consult certain important county officials with the object of securing their support for schemes of intensive food production, I carried away from the conference one conclusion only: that the counties of England were of two kinds, those which were already doing much and were unable therefore to do more, and those which were doing little because there was no more to be done. In spite of this close application of the doctrine of Candide—that all is for the best in the best of all possible worlds—I was able to set up some sort of county horticultural organisation, scrappy, amateurish, but enthusiastic, and the work done by that organisation was, on the average, good; so much so, indeed, that when after the armistice I sought to build up a permanent county horticultural organisation I was met by a changed temper. The schemes which the staff of the Horticultural Division had elaborated as the result of experience during the war were received and adopted with a cordiality which I like to think was evoked no less by the excellence of the schemes themselves than by the promise of liberal financial assistance in their execution. Thus it came about that when the time arrived for me to hand over the Controllership of Horticulture to my successor, almost every county had established a strong county horticultural committee, and the chief counties from the point of view of intensive cultivation had provided themselves with a staff competent to demonstrate not only to cottagers and allotment holders, but also to smallholders and commercial growers, the best methods of intensive cultivation.

By means of county stations the local cultivator may learn how to plant and maintain his fruit plantation and how to crop his vegetable quarters, what stock to run, and what varieties to grow. Farm stations—with the research stations established previously by the Ministry: Long Ashton and East Malling for fruit investigations; the Lea Valley Growers' Association and Rothamsted for investigation of soil problems and pathology; the Imperial College of Science for research in plant physiology, together with a couple of stations, contemplated before the war, for local investigation of vegetable cultivation; an alliance with the Royal Horticultural Society's Research Station at Wisley, and with the John Innes Horticultural Institute for research in genetics; the Ormskirk Potato Trial Station; a Poultry Institute; and, most important of all from the point of view of education, the establishment at Cambridge of a School of Horticulture—constitute a horticultural organisation which, if properly co-ordinated and (dare I say it?) directed, should prove of supreme value to all classes of intensive cultivators. To achieve that result, however, something more than a permissive attitude on the part of the Ministry is required, and in completing the design of it I had hoped also to remain a part of that organisation long enough to assist in securing its functioning as a living, plastic, resourceful, directive force—a horticultural cerebrum. Thus developed, it is my conviction that this instrument is capable of bringing horticulture to a pitch of perfection undreamed of at the present time either in this country or elsewhere.

In my view, horticulture has suffered in the past because the fostering of it was only incidental to the work of the Ministry. In spite of the fact that it had not a little to be grateful for—as, for example, the research stations to which I have referred—horticulture had been regarded rather as an agricultural sideshow than as a thing in itself. My intention, in which I was encouraged by Lord Ernle, Lord Lee, and Sir Daniel Hall, was to peg out on behalf of horticulture a large and valid claim and to work that claim. The conception of horticulture which I entertained was that comprised in the "petite culture" of the French. It included crops and stock, fruit and vegetables, flower and bulb and seed crops, potatoes, and pigs and poultry and bees. I held the view, and still hold it, that the small man's interests cannot be fostered by the big man's care; that horticulture is a thing in itself, and requires constant consideration by horticulturists and not occasional help from agriculturally minded people, however distinguished and capable. I hold that education—sympathetic and systematic—is an instrument the power of which, for our purpose, is scarcely yet tried; is, in fact, of almost infinite potency.

The truth is that great skill and sure knowledge exist among small cultivators side by side with much ignorance and moderate practical ability. Herein lies the opportunity of the kind of education which I have in mind. But for any such intensive system of education to prevail the isolation both of cultivators and of Government Departments must be abolished. There is only one way to prepare the ground for the intensive cultivation of education, and that is to secure the full co-operation of officials and cultivators. If this be not done, the official must continue to bear with resignation the unconcealed hostility of those he wishes to assist. That a state of confidence and co-operation may be established is proved by the record of the Horticultural Advisory Committee which was set up by Lord Ernle during my Controllership. The Committee consisted of representatives of all the many branches of horticulture—fruit-growers, nurserymen, market gardeners, growers under glass, salesmen, researchers, and so forth. That Committee became, as it were, the Deputy-Controller of Horticulture. To it all large questions of policy were referred, and to its disinterested service horticulture owes a great debt. That its existence has been rendered permanent by Lord Lee is of good augury for the future of intensive cultivation.

It may be asked: What are the subjects in which growers require education? To answer that question fully would require an address in itself. Among those subjects, however, mention may be made of a few: the extermination or top-grafting of unthrifty fruit, the proper spacing and pruning of fruit-trees, the use of suitable stocks, systematic orchard-spraying, the use of thrifty varieties of bush fruit and the proper manuring thereof, the choice of varieties suitable to given soils and districts and for early cropping, the better grading and packing of fruit. Of all methods of instruction in this last subject the best is that provided by fruit exhibitions. Those interested in the promotion of British fruit-growing will well remember the object-lesson in good and bad packing provided by the first Eastern Counties Fruit Show, held at Cambridge in 1919. That exhibition, organised by the East Anglian fruit-growers with the assistance of the Horticultural Division of the Ministry of Agriculture, demonstrated three things—first, that fruit of the finest quality is being grown in East Anglia;

secondly, that this district may perhaps become the largest fruit-growing region in England; and, thirdly, that among many growers profound ignorance exists with respect to the preparation of fruit for market.

I believe that no administrator, save the rare genius, can direct the expert, whereas the expert with trained scientific mind and possessed of a fair measure of administrative ability can direct any but a genius for administration. If the work of a Government office is to be and remain purely administrative, no creative capacity is required, and it may be left in the sure and safe and able hands of the trained administrator; but if the work is to be creative it must be under the direction of minds turned as only research can turn them—in the direction of creativeness. To the technically initiated initiation is easy and attractive, to the uninitiated it is difficult and repugnant. The useful work that such a staff as I have indicated would find to do is well-nigh endless. It would become a bureau of information in national horticulture, and the knowledge which it acquired would be of no less use to investigators than to the industry. Diseases ravage our orchards and gardens; some are known to be remediable and yet persist, others require immediate and vigorous team-wise investigation, and yet continue to be investigated by solitary workers or single research institutions. Certain new varieties of some soft fruits are known to be better than the older varieties, and yet the latter continue to be widely cultivated. The transport and distribution of perishable fruit are often inadequate—"making a famine where abundance lies." The information gathered in during the constant survey of the progress of horticulture would serve not only to direct educational effort into useful channels, but to stimulate and assist research.

The tacit assumption which has so far underlain my address is that an extension of intensive cultivation in this country is desirable. I have indicated that areas are to be discovered where soil and climate are favourable to this form of husbandry, and that by the establishment of a proper form of research—administrative—and educational organisation the already high standard reached by intensive cultivators may be surpassed. It remains to inquire whether any large increase in the area under intensive cultivation is, in fact, either desirable or probable.

The dispassionate inquirer will find his task by no means easy. He should, as a preliminary, endeavour to discern in the present welter of cosmic disturbance what are likely to be the economic conditions of the politician's promised land—the new world which was to be created from the travail of war. In the first place, and no matter how academic he may be, he cannot fail to recognise the fact that costs of production, including labour, are at least twice, and probably two and a half times, those of pre-war days, and he must assume that the increase is permanent and not unlikely to augment. What this means to the different forms of cultivation may be judged from the following estimates of capital costs of cultivation of different kinds:

Labour and Capital for Farming and Intensive Cultivation.

—	Labour per 100 acres. Men.	Capital per acre. Pre-war. £	Present. £
Mixed Farming	3–5	10	20–25
Fruit and vegetable growing	20–30	50	100–125
Intensive cultivation in the open (French gardening)	200	750	1,500–1,875
Cultivation under glass ...	200–300	2,000	4,000–5,000

In the second place, the inquirer is bound to assume that the intensive cultivator of the future, like his predecessor in the past, will have to be prepared to face the competition of the world.

But, on the other hand, he may find some comfort in the fact that both immediately before and, still more, after the war, the standard of living both in this country and throughout the world was, and is still, rising. Hence he may perhaps expect a less severe competition from foreign growers, and also a better market at home. He may also derive comfort from the reflection that the increased cost of production which he must bear must also, perhaps in no less measure, be borne by his foreign competitors. Even before the war the cost of production of one of the chief horticultural crops—apples—was no higher in this country than in that of our main competitors. There are also certain other apparently minor, but really important, reasons for optimism with regard to the prospects of intensive cultivation. Among these is the increasing use of road in lieu of rail transport for the marketing of horticultural produce. The advantages of motor over rail transport for the carriage of perishable produce for relatively short distances—say up to 75 miles from market—lie in its greater punctuality, economy of handling, and elasticity. Fruit crops ripen rapidly and more or less simultaneously throughout a given district. They must be put on the market forthwith or are useless. A train service, no matter how well organised, does not seem able to cope with gluts, and hence it arises that a season of abundance in the country rarely means a like plenty to the consumer. Increasing knowledge of food values, together with the general rise in the standard of living, also present features of good augury to the intensive cultivator. Jam and tomatoes and primeurs may be taken as texts.

In 1914 the consumption of jam in the United Kingdom amounted to about a spoonful a day per person. The more exact figures are 2 oz. per week, or 126,000 tons per annum. It is difficult to estimate the area under jam-fruit—plums, strawberry, raspberry, currants, etc.—required to produce this tonnage, but it may be put at between 10,000 and 20,000 acres. By 1918, thanks to the wisdom of the Army authorities in insisting on a large ration of jam for the troops, and thanks also to the scarcity and quality of margarine, the consumption of jam had more than doubled. From 126,000 tons in 1914 it reached 340,000 tons in 1918. To supply this ration would require the produce of from 25,000 to 50,000 acres of orchard, which in turn would directly employ the labour of, say, from 5000 to 10,000 men. Yet even the tonnage consumed in 1918 allows only a meagre ration of little more than a couple of spoonsful a day. It may therefore be anticipated that if, as is probable, albeit only because of the immanence of margarine, the new-found public taste for jam endures, fruit-growers in this country will find a considerable and profitable extension in supplying this demand.

The remarkable increase in consumption which the tomato has achieved would seem to support this conclusion. Fifty years ago, as Mr. Robbins has mentioned in his paper on "Intensive Cultivation" (*Journal of the Board of Agriculture*, vol. xxv., No. 12, March, 1919), this fruit was all but unused as a food. To-day the production in this country amounts to upwards of 45,000 tons. Yet the demand for tomatoes has increased so rapidly—the appetite growing by what it feeds upon—that the imports in 1913 from the Channel Islands, Holland, France, Portugal,

Spain, Canary Islands, and Italy amounted to nearly double the home crop, viz. 80,000 tons, making the total annual consumption not less than 1¼ tons, or about 2 lb. per week per head of population. Is it too fanciful to discern in this rapidly growing increase in the consumption of such accessory foodstuffs as jam and tomatoes, not merely an indication of a general rise in the standard of living and a desire on the part of the community as a whole to share in the luxuries of the rich, but also a sign that in a practical, instinctive, unconscious way the public has discovered simultaneously with the physiologists that a monotonous diet means malnutrition, and that even in a dietetic sense man cannot live by bread alone? If, as I think, the increasing consumption of the accessory foods which intensive cultivation provides represents not merely a craving for luxuries, but an instinctive demand for the so-called accessory food-bodies which are essential to health, then it may be expected that, as has been illustrated in the case of jam and potatoes, consumption will continue to increase. If this be so, the demand both for fresh fruit and also for "primeurs"—early vegetables—should grow, and should be supplied, at least in part, by the intensive cultivators of this country.

If the home producer can place his wares on the market at a price that can compete with imported produce—and it is not improbable that he will be able to do so—he need not, even with increased production, apprehend more loss from lack of demand than he has had to face in the past. Seasonal and other occasional gluts he must, of course, expect.

Even when judged by pre-war values, his market, as indicated by imports, is a capacious one. Thus in 1913 the imports into the United Kingdom of products from small holdings were of the value of about 50,000,000*l.* sterling. To-day it is safe to compute them at more than 100,000,000*l.* To that sum—of 50,000,00*l.*—imported vegetables contributed 5,500,000*l.* sterling, apples 2,250,000*l.*, other fruits nearly 3,000,000*l.*, eggs and poultry more than 10,000,000*l.*, rabbits and rabbit-skins 1,500,000*l.*, and bacon and pork more than 22,000,000*l.* No one whose enthusiasm did not altogether outrun both his discretion and knowledge would suggest that the home producer could supply the whole, or even the greater part, of these commodities. But, on the other hand, few of those who have knowledge of the skill and resources of our intensive cultivators, and of the suitability of favoured parts of this country for intensive cultivation, will doubt that a modest proportion, say, for example, one-fifth, might be produced at home. This on a post-war basis would amount in value to more than 20,000,000*l.*, would require the use of several hundred thousand acres of land, and would provide employment for about 100,000 men.

The estimated acreage under fruit in England and Wales is:

	Acres.
Apples	170,000
Pears	10,000
Plums	17,000
Cherries	10,000
Strawberries	13,000
Raspberries	6,000
Currants and gooseberries ...	22,000
	248,000

exclusive of mixed orchards and plantations.

These figures are, however, well-nigh useless as indicating the areas devoted to the intensive cultivation of fruit for direct consumption. Of the 170,000 acres of apples, cider-fruit probably occupies not less than 100,000, and of this area much ground is cumbered with old and neglected trees. Of the 10,000 acres in pears some 8000 are devoted to perry production, and hence lie outside our immediate preoccupation. Having regard, however, to the reduction of acreage under fruit, to the increasing consumption of fruit and jam, and to the success which has attended intelligent planting in the past, it may be concluded that a good many thousand acres of fruit might be planted in this country with good prospects of success.

Lastly, it remains to consider what results are likely to occur if intensive cultivation comes to be more generally practised in this country.

It may, of course, be true that a chance word, a common soldier, a girl at the door of an inn, have changed, or almost changed, the fate of nations, but it is probable that the genius of peoples and the pressure of economic and social forces are more potent. Is there then, it may be asked, any indication that the people of this country will seek in intensive cultivation a means of colonising their own land rather than continue to export their surplus manpower? The problem is too complex and too subtle for me to solve, but I will conclude by citing a curious fact which may have real significance in indicating that if a nation so wills it may retain its surplus population on the land by adjusting the intensity of its cultivation to the density of its population. If a diagram be made combining the intensity of production of a given crop, *e.g.* the potato, as grown in the chief industrial countries of the world, it will be found that the curve of production coincides closely with that of density of population.

Density of Population and Intensity of Production. Potatoes.

	Density of population square mile.	Percentage of population.	Percentage of yield	Yield in tons per acre less seed. Average 1911-13.
United States	31	10	33	1·3
France	193	62	56	2·2
Germany	311	100	100	3·9
U.K.	374	120	110	4·3
England and Wales ...	550	177	128	5
Belgium	658	212	155	6·04

From these facts we may take comfort, for they indicate that as a population increases so does the intensity of its cultivation: the tide which flows into the towns may be made to ebb again into the country. The rate of return, however, must depend on many factors: the proclivities of peoples, the relative attractiveness of urban and rural life and of life at home and abroad, but ultimately the settlement or non-settlement of the countryside must be determined by the degree of success of the average intensive cultivator. The abler man can command success; whether the man of average ability and industry can achieve it will, I believe, depend ultimately on education. He can look for no assistance in the form of restricted imports. He must be prepared to face open competition. Wherefore he should receive all the help which the State can render; and the measure of success which he, and hence the State, achieves will be determined ultimately by the quality and kind of education which he is able to obtain.