

the fully developed insects. That the early stages are also passed in a variety of situations seems probable, and the list of plants on which the fully developed beetle is to be found is very varied. On such a plant as the mustard one may often observe this beetle greedily devouring pollen from the dehiscent anthers, or tearing apart sepals and petals in order to reach the stamens, while as often one may find it sipping the nectar from the glands. The beetle thus receives from the host plant a safe resting place for its eggs, a home for the larva and pupa, and in the later stages both pollen and nectar as food and drink respectively. In return for those things the insect gives to the host plant its services as a pollinator. Beetles possess two pairs of wings, and of these the upper pair is usually modified so as to form cases, useless in flight, but used to protect the delicate membranous lower wings by which the insect flies. One may often observe *Meligethes* on the wing, but as often it may be found crawling among the flowers, and unable to raise its wings. In this condition it wanders from flower to flower, and at times one finds it with its back thickly coated with pollen which has adhered to its scale wings which have been rendered sticky with nectar in which, while over-indulging, it has stumbled. That the insect at times becomes intoxicated with nectar has been proved experimentally, and while in this condition it loses full control of its limbs and accomplishes during its wanderings a very extensive cross-pollination.

It has been found impossible to deal in detail with any of the points referred to above, and the sole object in view has been brief illustration.

FRENCH GARDENING.

By J. RENNIE.

[Read 12th December, 1911.]

It seems to me that your honoured president keeps a sharp lookout over all stray visitors to Rothesay. In June last I happened to pass through this central spot for changing steamers, met your president, said something about gardening in general, and intensive culture in particular, and well, here I am with the intention of trying to explain to you what that branch of intensive culture called French Gardening in this country *is*.

As to what it is, let me read to you an extract from Prince Kropotkin's "Fields, Factories and Workshops" as it stands in a book called French Gardening, by Th. Smith.

"While science devotes its chief attention to industrial pursuits, a limited number of lovers of nature and a legion of workers whose very names will remain unknown to posterity have created of late an entirely new agriculture, as superior to modern farming as modern farming is superior to the old three fields system of our ancestors. . . . They smile when we boast about the rotation system having permitted us to take from the field one crop every year, or four crops each three years, because their ambition is to have six and nine crops from the very same plot of land during the twelve months. They do not understand our talk about good and bad soils because they make the soil themselves."

Fifty years ago the "culture maraîchère" was quite primitive. But now the Paris gardener not only defies the soil—he would grow the same crops on an asphalt pavement—he defies climate. His walls which are built to reflect light, and to protect the wall trees from the northern winds, his wall tree shades and glass protectors, his frames and pepinières have made a real garden, a rich southern garden, out of the suburbs of Paris.

He has given to Paris the "two degrees less of latitude" after which a French scientific writer was longing; he supplies his city with mountains of grapes and fruit at any season; and in the early spring he inundates and perfumes it with flowers. But he does not grow only articles of luxury. The culture of plain vegetables on a large scale is spreading every year; and the results are so good that there are now practical maraîchers who venture to maintain that if all the food, animal and vegetable, necessary for $3\frac{1}{2}$ million inhabitants of the departments of Seine and Seine et Oise had to be grown on their own territory (3520 square miles) it could be grown without resorting to any other methods of culture than those already in use—methods already tested on a large scale and proved to be successful. As a matter of fact, if we analyse their system we see that its very essence is first to create for the plant a nutritive and porous soil, which contains both the necessary decaying organic matter and the inorganic compounds; and then to keep that soil and the surrounding atmosphere at a temperature and moisture superior to those of the open air. The whole system is summed up in these few words. If the French "maraîcher" spends prodigies of labour, intelligence and imagination in combining different kinds of manure so as to make them ferment at a given speed, he does so for no purpose but the above, a nourishing soil and a desired equal temperature of the air and the soil." That is a very fair account of what we call French Gardening in this country. It does not mention inter-cropping.

Without going into exact dates regarding French Gardening let me give you a short résumé of its history and develop-

ment. The start was made about 100 years ago near Paris. As the tourist from England approaches Paris he can see out of the train windows many gardens worked on this system. Three years ago it was estimated that round Paris there were 360,000 lights, 3 to a frame, and 2,160,000 bell glasses or cloches. The same system is used all over France, mainly in the neighbourhood of large cities, and it has spread into Belgium and Holland.

In 1905 the first French Garden was started at Evesham in England, a French expert being employed. Other gardens in England have followed. A few have been started in Scotland.

I mention these details to show you the age of the system, its distribution in time and space, and its development in these islands. Like all things it grew from small beginnings and developed. There were the usual doubts and shaking of heads when it was proposed to start it on this side of the Channel. The climate wasn't good enough, labour was too dear, it was too laborious, land couldn't be had on good enough terms to invest so much money in; but as I have told you it has been started, and is now being given a fair trial.

In 1908 the "Daily Mail" wrote up the subject. Some folks lost their heads altogether. Profits anywhere from £400 to £800 per acre per annum were freely talked about. When such figures came to be looked into, I need hardly say they had to suffer a serious diminution.

I shall now try and give you an idea how the system is worked, what special crops are grown, the manures, tools and appliances used when crops are sown and planted, how they are inter-cropped, and shall take it for granted that the marketing and financial side of the question does not interest this meeting very much. Let me quote again Prince Kropotkin's words.

"If we analyse their system, we see that its very essence is first, to create for the plant a nutritive and porous

soil, which contains both the necessary decaying organic matter and the inorganic compounds, and then to keep that soil and the surrounding atmosphere at a temperature and moisture superior to those of the open air."

To translate that definition into terms of work, I think it best to tell you how I work in my own garden in a small way to suit my own requirements. Afterwards I shall give you a description how a market gardener works on a large scale. About the middle of January 1910 I assembled the following:—

- 2 loads of long horse manure.
- 1 load delivered about October 1909.
- 1 load fresh from stables.
- 1 French Garden frame with three Lights.
- 3 or 4 mats, about one dozen Bell Glasses.
- 1 packet early radish seeds.
- 1 packet early carrot seeds.
- 150 Forcing lettuce plants—2 sorts.

A few words of explanation regarding these. A French Garden frame is 13 feet long by 4 feet 5 inches wide, 9 inches at back, 7 inches in front, with a short leg at each corner. This is the form of frame that has been proved the best for this work. When the lights are on, work such as watering is done from the back. One hand holding up the light against the checks in front, the other working watering pot or hose. Mats are required to cover the frames. These are made either of rye straw or reeds. They are about $1\frac{1}{2}$ inches thick, easily rolled up and of such size that two of them cover one frame. The radish and carrot seeds are special forcing kinds. Lettuce plants are also of a special forcing kind for this work. I got them from professional growers who had sown them in September or October of the previous year and kept them under bell glasses. The bell glasses have no knob and are about 17 inches diameter and 15 inches high. Sometime before this a space of ground 15 by $6\frac{1}{2}$ feet had been weeded, covered with some of the short manure shaken out of the October delivery, and dug over one spade deep. The top

spit over this space was then shovelled up into a ridge-like-heap, like a potato bing, and beaten smooth to shed off the rain. This was made on a spot handy to shovel into the frame later on.

A mixture of old and new manure was then forked over this space to a depth of say 10 inches. The frame was then set on top of manure and the binged up soil shovelled into frame to a depth of 4 or 5 inches, bringing the soil to within 3 or 4 inches of the top edge of frame. The soil was then worked down fine, stones and trash being raked off. The radish and carrot seeds were sown thinly and raked in. The soil was beaten flat and 126 cabbage lettuces planted 8 by 8 inches. The 3 lights were put on and covered with 2 mats.

The same process was gone through as regards making hot bed with the ground at end of frame, but covered with bell glasses instead of a frame, and cos and cabbage lettuce planted under and between them, being matted as before.

We now have our experiment in French Gardening fairly under way, the ground carrying two seeded crops and one planted. One's first impression is, won't there be a fearful jungle when they come up? and so there would be, if they all came up at the same time. But they don't. The frames and glasses are covered with mats every evening and uncovered every morning; the weather being favourable. Little air is given and no water till the radishes are up and cleared off, say in six weeks. By this time the weather is warmer and the lettuces are growing fast. They, in their turn, should be fit to clear off early in April. When this is done the ground gets a thorough soaking from the watering-pot to hurry up the carrots, and twelve early cauliflowers are planted.

Generally in this country by the middle of May the rigours of winter show signs of departing and the cauliflowers grow up and touch the glass. Then the frame is hoisted up and a wad of manure kicked under the legs, any space showing under the lower edge being also filled up with manure.

Later on you speculate with the weather, give more air by raising the lights. Then take them away altogether, and later still the frame itself. Leaving an open air crop of carrots and cauliflowers.

Sometime in June these two crops were cleared off, leaving three good growing months ahead. As the cauliflowers were pulled I planted another crop of the same, and intercropped with one third, cos lettuce, one third cabbage lettuce planted, and one third turnip seed sown. By the time these last crops are mature, coldish autumn weather had come on. The following six crops had been secured radish, lettuce, carrots, two crops cauliflower, and a mixed crop of lettuce and turnips. I then used frame for growing on flower seeds. Now I do not hold this up as what a professional market gardener would do, because lettuces grown on hotbeds in summer cannot compete in price with stuff grown more cheaply in ordinary good soil. He would probably grow French Beans, Cucumbers, Melons or Tomatos, and intercrop with some thing that would be off the ground before he wanted it to start the rotation again.

Well! a time came when the last crop was off the ground. The surface was cleaned, and earth and hotbed were forked up and mixed together, shovelled into a bing, and put handy for the next year.

The mixing of the soil *in* which the season's crops have grown with the hotbed of dung *over* which they have grown is a point I would specially draw your attention to. You can easily see that after two or three years of this routine the top spit will be mainly manure in various stages of rotting and fermentation. It is this kind of soil that the French gardener strives to have and to make. It is his chief assistant, his capital consists of it, and when he shifts to a new site he takes it with him. There is no doubt that in this kind of soil vegetables, and especially salading vegetables, grow to perfection. Early this year, in February, the hotbed was made as before, last year's hotbed and earth put

on top, and the following crops taken off:—Radish, cabbage, lettuce, carrots, two crops cauliflower, brocolli, which last is growing now.

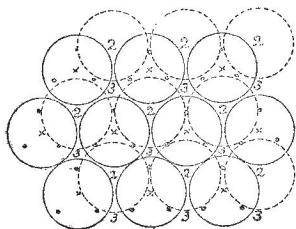
Now, going back a bit, we will suppose that this is a bare field to be turned into a French garden. Possession has been got in spring. A certain amount of ground has been cleaned, manured, and dug over, marked out, paths made, etc.; engine, pump, tank, water pipes procured and made ready; shed and stable built; manure, frames, bell-glasses, etc., got on to the ground. All that work will bring you to autumn, say sometime in September, when the French Garden year is supposed to begin. In the nursery beds cos and cabbage lettuce and cauliflower are sown under bell-glasses. Digging and cleaning routine goes on. The crops sown come up, and as soon as they are big enough to handle are transplanted under bell-glasses, sometimes into frames. These seedlings are given plenty of air, are protected by mats during inclement weather, and if they show too vigorous a growth, are again transplanted. This checks top growth, and makes a short, sturdy plant with a robust root system.

Early in the year, say January, the first hotbeds are made. It may interest you to hear how a professional starts to make hotbeds. I told you before about the top spit of soil being binged up to keep it dry. Hotbeds cannot be made when rain or snow is falling, neither is it advisable to put rain-sodden soil on a hotbed. So during a spell of dry weather the soil has been binged up on plot.

Suppose we have a gang of four men, one filling, two carrying, and one spreading manure. I say carrying manure advisedly, for in a French Garden there is no room for wheelbarrows. All manure is carried to hotbeds in baskets on men's backs in knapsack fashion. Manure is carried and spread say 10 inches deep. Frames are brought, laid down ends touching in a straight line. All hands shovel earth into them from ends of bings, thus making room for the next line of frames, which are to come here. The routine I

described in the one frame experiment is gone through. Sowing or planting may be done at once, or a few days after, but in any case the lights must go on. A space of 10 inches its shallowness admits of growing plants near the glass. Its shallowness admits of growing plants near the glass. is left between the front of one row of frames and the back of the next. The 10-inch walk is filled with manure, and the ends of both rows of frames and the back of the first row have manure piled up against them level with the top of frame. This helps to keep in the heat.

The same routine goes on, continuing the rows until the desired space is covered—cross paths are also left. This plot we'll say is to be used for growing cos and cabbage lettuce under bellglasses. Three rows of bellglasses when set down



Arrangement of Bell Glasses.

1 inch apart take up about the width of a frame. A hotbed is prepared and sown thinly with carrot seed and three rows of bellglasses put down. A path 18 inches wide is left between this hotbed and the next. Then by tipping the bellglasses against each other and working from both sides one cos lettuce is planted under the centre of each bellglasses and three cabbage lettuce round it as shown in diagram. Then outside the bellglasses one cos lettuce is planted where marked at 2 and 3.

The radishes come off first. The cabbage lettuce come off next, then cos lettuce No 1. The bellglasses are shifted over two and finally three. Cauliflowers may be planted instead of No 1 cos lettuce. Early in June all these crops should be over. The bed is then cleaned, forked over, and sown or planted with an open air crop.

So far I have only spoken of the raising of early crops say up to May or June under glass. I shall now show you how the frames and bellglasses are used to raise and protect crops that require heat. This heat is got from hotbeds under glass and from increasing sun heat.

During the spring months hotbeds with more manure in them than previously described are made up and frames put over them. Such crops as melons, cucumbers, French beans and vegetable marrows are sown on them. These seedlings in due time are planted out on hotbeds, and covered with the frames and sashes which protected the earlier crops.

By the time these last are off the ground the season is too far advanced for more hotbed work. Most of the frames and bellglasses are piled away till next season, a few being used to forward such crops as may be wanted to cover parts of the ground during winter—such as cabbages, endive, Br. sprouts, brocolli, etc.

I have now given you an outline of what the system is, what appliances are used and how, what crops are usually grown, how the appliances are kept in as full use as possible, how several different crops are grown at the same time. I shall now give some figures as to what capital is needed for a garden, and some figures regarding returns in money.

As for capital, Mons. L. Bussard gives in his book, that for a garden of one hectare near Paris the sum of £1140 is necessary for capital. Now a hectare of land is equal to 2.47 statute acres, say $2\frac{1}{2}$ acres. Of this space seven-tenths are

for open air cultivation. The remaining three-tenths being half under frames and half under B.G. The first year's expenses are £925, and the first year's income £1166.

Mr Thos. Smith in his book on French Gardening gives the following figures for the equipment of a 2 acre garden in England. The details may interest you as showing where the money goes:—

630 lights and 210 frames to be painted and glazed at home,	£300
2800 B.G.,	145
1000 mats, with carriage,	80
Water supply,	150
Packing shed and stables,	100
Fence 420 yards at 5s,	105
Tools and sundries,	35
1200 tons of manure at 5s,	300
Horse, cart, waggon and harness,	75
Total,	£1290

For working expenses and maintenance for 18 months he allows as follows:—

Wages of expert at £2 10s per week. 78 weeks,	£195
Wages of two labourers £1 per week. 78 weeks,	156
Two women for packing (part time),	15
Rent, rates, and water (18 months),	50
Keep, etc., of horse (18 months),	39
Maintenance of working proprietor (18 months),	150
Total,	£605

He estimates the first year's returns to be £800.

The proprietor to give his full time working in the garden. After the second year, the services of the expert to be dispensed with.

Report of the Council of the Buteshire Natural History Society to the Sixth Annual General Meeting of the Society, held in the Bute Museum, Battery Place, Rothesay, on Tuesday, 28th November, 1911, at 8 p.m.

The programme arranged for last winter was duly carried out, meetings of the Society having been held on 29th November, 20th December, 13th and 24th January, 14th and 28th February, and 7th March.

The papers contributed were printed as the Fourth Volume of the Society's Transactions, and a copy sent to each member. The Meteorological Observations made by Mr D. Penney, at Glenburn, as tabulated with the assistance of various members, are included in the Transactions.

A programme of meetings for the ensuing winter and spring has been arranged and is in the hands of the members.

The Society had two excursions during the summer. On 6th May, through the kindness of Lord Bute, the members visited the Fish Hatcheries, and on 13th May they visited the Marine Station, Millport. Both excursions were well attended.

No examinations for young people were conducted during the year, but the School Board of Rothesay have again recognised the Educational advantages afforded by the Society by renewing their grant to the extent of £3 3s.