

It may be argued that in other localities where factories do not exist ryots obtain more handsome profits than they do by selling to the factory and that such a state of affairs may also come into being in this area. But the fact is that only on account of the existence of the factory the area under canes has increased beyond one's original expectations, and in this area as long as the present conditions remain jaggery making is not likely to replace the sale of canes to the factory. It will be interesting to know how in other farms where sugarcane is cultivated the several items of expenditure range and what proportion they bear to the total cost of production.

### The "Pollu" Disease of Pepper.

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Pepper (*Piper nigrum*) is a characteristic crop of the West Coast—especially of Malabar. A native of the damp ever-green zone of the forests of the Western Ghats, it flourishes in all suitable situations in the moist rainy tract of Malabar. In almost every compound in Malabar the vine may be found trained on the stems of tall trees, the produce being usually intended for the consumption of the household, but as a regular crop, however, Pepper is found cultivated mostly in the interior valleys of the sub-montane region and in Wynaad above the Ghats. Here hillsides are cleared and standards mostly of *Erythrina* are first planted, and the pepper vines are later on trained on them. These pepper gardens are often of large extent and in good seasons bring in a plentiful harvest. Pepper is a spice characteristic of moist tropical regions like Malabar and in ancient days it was a valuable commodity that formed the main medium of barter for goods imported from outside and was, therefore, appropriately termed "the money of Malabar."

Pepper is however subject to the attacks of certain pests and diseases which combine to reduce the profits of cultivation considerably. A good many of the pests and diseases are usually of minor importance and of casual occurrence, but there are some which are of a serious nature of which the Wilt of the Pepper Vine studied by Dr. Barber in Wynaad is one, and the "Pollu" disease of North Malabar—the subject of the present paper—is another. "Pollu" lite-



rally means "*hollow*" and is usually applied to the occurrence in varying numbers on individual spikes of empty berries the interior of which has been hollowed out mostly by insect agency. In a wider sense it is more often employed to denote the loss occasioned by the presence in varying quantities of improperly developed or damaged berries of low commercial value in the harvested crop. While the proportion of such worthless berries to the sound ones has been estimated at the Taliparamba Pepper Farm during the last 15 years as varying from 6 to 60 per cent, there is little doubt that the real loss sustained is vastly greater, for most of the hollow berries damaged by insect agency are so fragile that they become reduced to powder during threshing, while a large proportion of the spikes dropping down owing to Fungus attack are never collected. The experience of the Pepper cultivators appears to be that "*Pollu*" is in greatest evidence when there are heavy rains at the time when berries begin to mature i. e. at the time of North-east monsoon in November-December, and this is confirmed by the observations made on the Farm during the past many years.

*The "Pollu" disease.* The disease is known to have been in existence at the time of starting the Taliparamba Farm and it is evidently a long-standing one—being probably co-eval with the history of the pepper crop itself in North Malabar. It was in 1908 that the existence of the disease was first brought to the notice of the Entomological staff and the writer had the opportunity of studying the disease at that time. He found that in reality two factors were at work: one—an insect—a Flea beetle grub boring in the berry and the other—a non-insect agency probably a fungus—causing the rotting of some of the berries and, what was more serious, also a fall of the spikes. It is regrettable that there were no opportunities of continuing this study further for some years thereafter. It was not till 1918 that further progress was made in our knowledge of the disease. The life history of the beetle was studied in greater detail by the Entomological Section and certain experiments were conducted towards checking the ravages of the pest; and an account of the results of these observations and experiments is given in "*A Preliminary investigation of the "Pollu" disease of Pepper in N. Malabar in 1918*" by Mr. T. V. Ramakrishna Ayyar assisted by Messrs. J. A. Muliyl and P. Susainathar in the Year Book for 1920-21. No further work was done till January 1923 when, following upon a very heavy attack of "*Pollu*" on an otherwise satisfactory pepper crop, the thread of investigation was taken up once again at the desire of Mr. R. D. Anstead—Director of Agriculture and it is the object of the present paper to give a general account of the results obtained so far.



"What is Pollu"? Even at the outset of the investigation of this disease it was realised that the "Pollu" trouble was no simple affair. It appeared in reality to signify the aggregate loss of crop brought about by two or three distinct causes, of which the presence of the Flea-beetle larvae causing the destruction of some of the green berries is but one. Besides the Fleabeetle, there is a Cecidomyiid or gall-fly, the maggots of which attack young berries and convert them into galls. There are, in addition, cases of individual berries either becoming entirely rotten or showing fairly deep cracks on the skin. There is, moreover, a very large number of spikes lost by a premature fall of spikes. All these cases proved to be caused by a Fungus—"Colletotrichum necator,"—as a result of an investigation by the Government Mycologist.

Furthermore, an examination showed that there were always a fair number of pepper spikes in which berries remained undeveloped and this caused the existence of numerous gaps. This was evidently due to want of proper fertilisation of the flowers and as it was mainly a botanical problem the Government Economic Botanist kindly arranged for the investigation of this part of the subject.

As the aggregate loss of crop may be influenced (1) partly by the absence of the right conditions of fertilisation (2), partly by the enormous volume of spike-fall or by the loss of individual berries caused by the activities of a fungus, or (3) partly by the causation of hollow berries due to insect agency, the necessity of the co-operation of three different sciences was felt and the necessary team work was kindly arranged by the Director of Agriculture and, in reviewing the work of the past two seasons, a fair amount of progress may, on the whole, be conceded to have been made.

#### *Nature and Extent of Loss.*

1. *Insect damage.* There are two insects damaging the berries: One is a Cecidomyiid maggot which burrows into tender berries and causes the formation of a gall which arrests all further growth. The lifehistory of this pest has not yet been fully investigated. The other is the grub of a Flea beetle—*Longitarsus nigripennis*. The beetle bites small shallow circular holes in the rind of the berry and lays a tiny elongate oval egg therein, after which it covers the egg up with its excreta. The egg hatches in about 5 days into a grub which burrows into the kernel and destroys it. The grub, thereupon, enters a neighbouring berry which is similarly hollowed out. One grub is in this way able to destroy 3 to 4 berries. Ultimately the grub drops to the ground, turns into a pupa at a depth of 2 to 3 inches and emerges as a beetle in about 10 days.



2. *The Fungus—Colletotrichum necator* is a fungus that is found living on the leaves, stems and spikes and berries. The damage caused to leaves, stems and individual berries is not of any serious character, but the loss sustained by the fall of entire spikes is not so negligible. In rainy weather the spores are washed down from the leaves and stems on to the petiole of the spike and if these spores happen to germinate at the origin of the petiole and the fungus penetrates into the tissues of the petiole, an abscission is formed at the point of origin and the spike falls of its own accord. The fall of spikes increases proportionately if the weather proves to be unusually moist and rainy.

It is rather a difficult matter to find out in the harvested crop the relative percentage of infestation of "Insect" and "Fungus" *Pollu*. At the time of harvest all ripe spikes are picked and heaped on the threshing floor, and at the same time such of the fallen spikes as appear to be likely to contain sound berries are collected and all these are thrashed together usually by trampling. Hence fragile bodies such as the hollow "*Pollu*" berries are reduced to powder and have no chance of surviving. What is usually called "*Pollu*" at the time of harvest has been on examination found to consist of such berries as have been partially damaged by the grub or have been attacked by the Fungus, and it is clear, therefore, that the quantity of such "*Pollu*" recorded year after year on the Farm is only a partial measure of the actual loss sustained by the cultivator, which is really much larger.

In December 1923, an attempt was made to arrive at an approximate estimate of the relative percentage of "*Pollu*" caused by insect agency and by Fungus. 50 spikes selected at random were taken from individual vines and figures were worked out for more than 30 vines conjointly by the Government Mycologist,—Mr. S. Sundararama Ayyar—and the writer. Insect "*Pollu*" was found to vary from 0.5% to 24% while the Fungus "*Pollu*" varied from 0.5% to 13 per cent. The year 1923, however, was an abnormal one there being little of the N. E. Monsoon rain and pepper was reported to be free from "*Pollu*" throughout the tract. Despite this fact, however, 208 Madras measures of "*Pollu*" (as against 1264 Madras measures of dry sound berries) were recorded at the Taliparamba Farm and the percentage of "*Pollu*" to sound berries worked out at 16.4 per cent.

An examination of the crop during the time of its maturity would clearly show that the main portion of the loss is occasioned not by individual berries becoming damaged by insect or Fungus attack but by the enormous amount of spike-fall that occurs at this time mainly through Fungus agency. As the activities of the Fungus are mostly



dependent on the amount of moisture prevalent at this part of the year, it naturally follows that there will be a heavier loss from "Pollu" in years of heavy precipitation at the time of the N. E. Monsoon.

**Remedial measures.** With the object of preventing such heavy loss from spike-fall, Bordeaux mixture, at strengths varying  $\frac{1}{2}$  to 2 per cent and mixed with various adhesives, such as Casein, Resin-soda and Fish oil rosin soap, was tried by the Government Mycologist on many of the vines in August-September 1923. The results of the spraying were found to be little short of the marvellous. Daily counts taken of certain treated and control vines showed that there was a very great diminution in the fall of spikes, while there was a conspicuous absence of insect or Fungus "Pollu" in the spikes of vines thus treated. The difference between treated vines was distinctly recognisable even to a casual observer.

The Bordeaux mixture had not only checked the activities of the Fungus but also had functioned as a repellent to the Pollu Fleabeetle and prevented it from laying eggs. Moreover the berries of spikes on treated vines were also found to be distinctly larger in size than those on untreated vines. The situation thus appeared to be very satisfactory, and it looked as if one might congratulate one self on having hit upon the right method of fighting the "Pollu" malady.

Later experience, however, showed that Bordeaux mixture was not an unmixed good. The berries on treated vines were found to require a longer time to come to maturity and the harvest time was therefore abnormally prolonged. Again, most of the treated vines were found to be specially attacked by mealy bugs (*Pseudococcus virgatus* and *Chionaspis aspidistrae*). While neighbouring untreated vines were free, sprayed vines were found specially subject to the mealy bugs, which gradually multiplied after the harvest until in April-May they were present in such abundance as to kill many of the runners. Sprayed vines were found therefore to have had a definite set-back by the beginning of the current season. The same experience appears likely to be repeated during the present year's spraying too, for mealy bugs were found to be prominently present on sprayed vines even at the beginning of October. It has thus become evident that, unless something can be done to check the progress of the mealy bug, spraying with Bordeaux mixture cannot be recommended to the public.



As to why Bordeaux mixture should have the effect of encouraging mealy bugs no positive reasons have yet been detected, but it is surmised that the mealy bugs have increased on sprayed vines because Bordeaux mixture kills certain Fungoid enemies of the bug which usually keep it under control. This supposition is strengthened by the experience of various observers in other countries as to an exactly similar effect on the increase of Scale insects by a spray of Bordeaux mixture. For instance, Withycombe in an article on "Recent progress with insecticides"—Tropical Agriculture. Vol. 1 No. 8 August 1924—makes the following remarks regarding Bordeaux mixture: "*Bordeaux mixture* is commonly considered as a sovereign remedy for all evil . . . The correct application is against rots, mildews and other Fungi. Against insects it has little or no killing power and it may sometimes even favour an increase of the pest. Such frequently appears when scale-infested trees are sprayed with this mixture. The scale insects increase instead of decreasing in number . . . . The probable reason of failure is not far to seek. Scale insects are controlled in nature to a large extent by certain insect-destroying fungi and especially in humid climates, are these beneficial fungi of importance. Bordeaux mixture by virtue of its fungicidal properties, arrests further spread of the insecticidal fungi and thus scale insects are allowed to multiply unmolested by their fungal enemies. . . ."

It is proposed to pursue the subject further during the coming season and devote some attention to find out how exactly the Bordeaux mixture favours the increase of the Mealy Bug.

Further progress in regard to control methods against the 'Pollu' Fleabeetle would thus appear to pivot on the question of the control of the Mealy Bug and the problem on hand serves to show how complicated the question of remedies really is and how interdependent the various factors in any problem are.

## EXTRACTS.

### Agriculture in Czechoslovakia.

BY DR. VLAD BRDLIK.

*A 6 year old republic.* The present country of Czechoslovakia was carved out of the old Anstro-Hungarian Empire when it broke up in 1918. This republic has an area of 54,240 square miles and contains a population of 13,612,172 souls. In the eastern provinces of Slovakia and Carpathian Ruthenia, 62 per cent of the population is agricultural while in the western industrialised provinces of