

construction or else run them as State wells, fitted with power lifts and charge water cess for the area irrigated by the wells. As a matter of fact the provision of State irrigation wells is not a new practice. During the reign of Pandia Kings, huge wells with excellent springs were dug in many places to encourage well-irrigation. Even now we come across some of those wells, though dilapidated in condition. In U. P. and Bihar, these are State-owned tube wells with a capacity of $1\frac{1}{2}$ cusecs, equivalent to 33,000 gallons of water per hour and each capable of irrigating 400 acres. The cost of each tube well is said to be Rs. 40,000/-. The possibility of digging such tube wells in our State also must be investigated. When large sums of public money are sunk in irrigation projects to benefit ryots in certain areas, it is but proper that the Government should extend such assistance to ryots in other less fortunately placed areas for the development of well-irrigation. No wonder that our Food Minister, Shri K. M. Munshi, attaches great importance to scheme which will increase the supply of water. In his eight-point programme, he pleads for the restoration of tanks and channels, wells and borings and construction of a large number of tube wells.

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Economics of Crop Production on Bapatla Sandy Soils

By

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Any visitor to Bapatla, as he approaches the place in the train would be struck with the view on both sides, of stretches of sandy belts, fallow or covered with crops and dotted with palmyra or cashew-nut trees. There may also be attractive green patches of paddy or tobacco, interspersed with jasmine or vegetables coming to view according to the season. A closer observation will reveal the presence of small ponds or 'doruvas', wells from which water is lifted in pots for 'irrigating' the adjacent crops. The sands drink up water and hence pot-watering is a continuous process from day to day. A visit to these areas will show that very good crops could be grown out of these poor sandy soils. A study of this type of crop production and its economics has been considered worthwhile and might be interest, particularly to students of agriculture.

Area and nature of soil. These sandy areas are found in the eastern and southern portions of Bapatla taluk and cover an area of about a hundred square miles. The area is fairly level, though in some places it is undulating. The sands are deep and have evidently been formed by the receding sea which is now about five and a half miles from the town of Bapatla. It is said that the temple in the heart of the town was built about 900 years ago by a Chola king and the sea was then washing the doors of the temple. The water table is as high as four to six feet. The water is generally brackish, but here and there fresh water springs are also found. By the accumulation of organic matter and by application of cattle manure and leaf composts the soils under cultivation have been improved in their fertility as seen by the very good stand of crops. A few miles from the shore there runs a narrow strip of low-level land for about 15 miles east to west, where good crops of paddy are raised by means of spring water alone. This is an interesting feature. The springs have been dug in sandy mounds on both sides of the pocket at intervals and they are kept in proper flow by renovating them every season.

The seasonal factor. The tract gets the benefit of both the monsoons. The average annual rainfall is 37.12 inches and the distribution is given below.

Statement showing monthly distribution of rainfall

January	Nil.	Inches	July	4.65	Inches
February	0.36	"	August	5.52	"
March	0.80	"	September	8.21	"
April	0.19	"	October	8.76	"
May	0.81	"	November	4.73	"
June	2.01	"	December	1.08	"

Total 37.12 inches.

The warm summer temperatures, typical of the Guntur district is somewhat tempered by the sea breeze. The cropping season, though not very well established owing to the variety of crops, is roughly as follows:

May to July—Paddy nurseries.

August to November—Tobacco nurseries.

December to March—Ragi, cow-pea, horsegram.

December to July—Chillies, Brinjal.

July to November—Groundnut.

July to August—planting of casuarina, jasmine etc.

(Cow-pea, horsegram and groundnut grown as rainfed crops)

The cultivators and their holdings. As can be expected from the nature of the cropping conditions the majority are small holders and owner cultivators. Some of them have also taken on lease small areas here and there, depending upon the number of workers in the family. The average size of a holding has to be measured in cents and one cultivator with his family of about two other members can manage only about 30 to 35 cents area in which there may be one or two *doruvus*. Some of the wetland ryots of the adjacent delta may also take up small areas on these sands to grow nurseries of paddy or tobacco which give them a good return. The areas originally belonging to Government have been given out in suitable blocks to the backward classes and these have settled in small areas of their own, living in thatched houses built near by. The members of their families work as casual labourers in the neighbouring wetland areas, particularly during the planting and harvest periods. In fact, most of them being small holders, their income from the crops alone will not be sufficient unless they supplement their income by other means. Hand-watering or pot watering of crops is a strenuous operation even for a strong man, as two big-sized pots are used, using both hands each time. The water is splashed on the plants, the quantity allowed being determined by the nature and age of the crop and the weather conditions.

Economics of production. It is difficult to assess the costs of production of the crops in this area, particularly because family labour is fully utilised and the assessment of values can only be approximate. The biggest item of expenditure will be that due to pot watering but it is not felt as cash expenditure and therefore when the charges of this irrigation are not included in the costs, the margin of profit is very high indeed. The statements given below for the various crops of the tract will give an idea of the cost of production and profits, but the value noted for own and family labour has to be borne in mind if the balance sheet is to be understood in its proper perspective. The costs have been worked out on the basis of one acre and labour by cattle is given as pair work days (PWD) and that by human as man work days (MWD), the labour of two women being considered to be equivalent to one man.

Scope for Grow More Food. By increased doses of organic and artificial manures the yields can be stepped up by 50 to 75 per cent, in the case of ragi and vegetable crops. As very good profits are obtained from the tobacco nursery business, the cultivators will not give up the raising of such nurseries. There are still large areas left fallow, belonging to the cultivators and Government which are available for further extension of areas under food crops. The cultivators have to be encouraged with advances or loans without interest to take up all the available area for growing of ragi, paddy and vegetables. The areas belonging to Government have to be given out on easy terms to the neighbouring ryots or other tenants

or landless labourers with supplies of manures at controlled rates, for growing of food crops. The Forest Department has been in charge of hundreds of acres of this area for the planting of casuarina for fuel purposes. Part of this area, cleared of casuarina or to be newly planted, may be devoted to food crops, by leasing them to ryots on favourable terms. Thus, if action is taken very early on the above lines, it may be estimated that at least about two thousand acres of new area may be brought under ragi, paddy and vegetables in the current season itself. The maximisation of yields in this area centres round the maximum application of manures, artificials and cakes etc., as the sandy soils of this tract respond to manuring very well.

Statements of cost of production and profits: We will not have a proper idea of the labour involved and profits obtained if the costs are worked out on an acre basis as given below, and as is the usual case in studies of costs but it should be worked out really on these sands on a family unit basis which can be fixed at between 25 and 35 cents area depending upon the crop. In such a case the pot watering and other human labour charges have to be eliminated if we should get the right idea of the actual cash income for the cultivator.

COST OF PRODUCTION

(Crops raised by own and family labour)

Area - one acre. (PWD—Pair work day Rs. 2; MWD—Man work Rs. 1.)

1. NURSERIES

No.	Particulars of operation	PADDY June-July			TOBACCO Sept. November			CASUARINA July-October		
		PWD	MWD	Rs.	PWD	MWD	Rs.	PWD	MWD	Rs.
1.	Preparatory Cultivation	3	3	9	3	3	9	25	25	
2.	Seeds and sowing		4	150		4	50	4	4	
3.	Manures & manuring	1	8	80	1	6	120	4	60	
4.	After cultivation		4	4		12	12	8	8	
5.	Irrigation (POT watering)		120	120		140	140	360	360	
6.	Pest control, spraying etc.					4	29			
7.	Horvesting—(Pul ing seedlings)							4	4	
8.	Total Cost			363			360			461
9.	Gross receipts			Seedlings sold to plant 40 acres @ Rs. 12 per acre (average rate) 480			Seedlings sold to plant 60 acres @ Rs. 15 per acre (average rate) 540			Seedlings sold to plant 200 acres @ Rs. 3 per acre (average rate) 600
10.	Nett profit			117			900			139

Note.— Paddy nurseries: If seed is supplied by the ryot who takes the seedlings, labour charges are paid to the sand cultivator. The seedlings are removed and transported in carts by the purchasers themselves.

Tobacco nurseries: Seedlings are pulled, packed in gunnies rather loosely and transported by rail by contractors. The price of seedlings vary very much according to the season from Rs. 5 to Rs. 80.

No.	Particulars of operation	RAGI			CHILLIES			BRINJALS			PLANTATION CASUARINA		
		PWD	MWD	RS.	PWD	MWD	RS.	PWD	MWD	RS.	PWD	MWD	RS.
1.	Preparatory cultivation.	4	4	12	3	3	9	3	3	10		3	3
2.	Seeds & sowings		4	16		4	16		8	30		10	15
3.	Manures & Manuring	1	4	20		4	60		4	30			
4.	After cultivation		8	8		4	4		5	5		3	3
5.	Irrigation; Pot-Watering		80	80		150	150		120	120		110	110
6.	Harvesting etc.,	2	12	14		10	10		25	25			
7.	Total Cost			150			249			220			151
8.	Gross receipts		12 bags or 2000 pounds at Rs. 16/bag Rs. 192			3000 lbs. at Rs. 15 per 100 lbs. Rs. 450			100 mds at Rs. 3 per md. Rs. 300			At the end of 6 years fuel worth Rs. 800	
9.	Nett Profit		Rs. 42			Rs. 201			Rs. 80			Rs 650	

Note.— Brinjals: Generally we do not find much area under brinjals as a pure crop, as the profit is less than from chillies and other crops since the vegetable is grown largely in the dry areas of Guntur taluk and markets are well supplied and prices not very favourable.

Casuarina: The plantation is ready for cutting 6 years after planting. Cutting and removal done by fuel contractors.

3. FLOWER CROP.

Jasmine: Season of flowering, March to July (5 years' crop)

	MWD	Rs.	Remarks		
1. Preparatory Cultivation	40	40	Includes planting cuttings of old crop.		
2. Seeds and sowings					
3. Manures and manuring				4	60
4. After-cultivation				20	20
5. Irrigation; Pot-watering				800	800
6. Harvesting				60	60
7. Total cost for 5 years		980			
8. Gross receipts	I year	50 seers of flowers			
	II "	200 "	" "		
	III "	300 "	" "		
	IV "	500 "	" "		
	V "	400 "	" "		
	Total	1450	" "		
9. Nett profit—	nil.	Loss over 5 years	Rs. 255.		

Note.— The area under jasmine is limited to a few cent only in each holding.

The Role of Plant Protection in Intensive Agriculture

By

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The Place of Plant Protection in Agriculture: Protection from enemies is one of the three fundamental requisites for the existence of any living matter, whether plant or animal on the face of the world. The other two aspects, adequate supply of food and adaptation to environment are equally important and the provision of these three primary biological necessities determine the continued existence and development of all living matter. In agriculture, the aspect of food supply and crop nutrition is studied by the Agricultural Chemist and elaborate manuring schedules in respect of different crops and different tracts have been evolved. The suitability and adaptability of crops to environment is dealt with by the Agronomist and Crop breeder and improved high yielding strains of various crops suitable to different areas have been evolved. Unfortunately, plant protection has remained a neglected subject in our country and our efforts in this direction have been till lately rudimentary and inadequate. It is not often admitted that all the researches and labours of the Agricultural Chemist, Agronomist, Crop-breeder and other agricultural scientists are set at naught by the incidence of pests or diseases. It is yet to be realised that unless all these three branches of agricultural science are developed co-extensively our efforts at progress and maximisation of agricultural production will be figuratively speaking attempts to keep a three-legged stool with one leg removed or very short in a position of stable equilibrium. In this connection an incident related by an American entomologist who visited Germany about 20 years ago is worth repetition to indicate how other countries view the question of Plant Protection. Germany grew very little corn but still the American entomologist found a number of laboratories intensively studying all aspects of the pests and diseases of corn. On inquiry he was informed that Germany intended to encourage corn cultivation but before that an organisation was being built up to meet any eventuality in case of the incidence of pests or diseases.

The Necessity for Plant Protection: An attitude of complacency on the part of the intelligentsia combined with the proverbial conservatism and an ingrained fatalistic outlook of our agricultural population have been mainly responsible for the neglect of Plant Protection in India.

The dislocation of foreign trade and food imports, economic and political upheavals, the world over, during and after the war have thrown us back on our own resources to produce sufficient

food for our ever-increasing population—and we have failed. We have retrogressively cut down our ration from 16 oz. to 12, from 12 to 8 and now from 8 to 7 oz. of our staple diet, rice. Gigantic efforts have been made and are still in progress costing the State crores and crores of money in the various schemes under the 'GROW MORE FOOD' campaign, with no palpable improvement in the overall situation.

It will be worthwhile to analyse the causes of this failure of our efforts, from the view-point of a Plant Protection Scientist. The practice of farming is one of the main causes for the upsetting of the balance of Nature. The more intensively farming is conducted, the greater is the interference with Nature. The use of specially evolved seed material and the practice of heavy manuring schedules to force abnormal yields are still further factors against Nature. And nature in her attempts to set right the balance reacts by favouring the abnormal multiplication of pests and diseases which subsist on these artificially raised and nurtured crops. We, in our efforts to increase agricultural production are creating exactly these conditions best calculated to favour the enormous increases of crop pests and diseases. We in our efforts to grow more food are actually and actively, even though unconsciously, partaking in "GROW MORE INSECTS" and "GROW MORE DISEASES" campaigns—and these have been to a very large extent successful. Tractors and pumpsets, ammonium sulphate, superphosphate and oil-cakes have been fully utilised by insects and diseases and the expected surplus has but gone to feed some additional millions of tiny mouths and insignificant spores, to make them strong to invade the next crop. The situation has so drastically changed over the last 10 years that we now very seldom hear of any crop that was not threatened by some insect pest or disease. The situation is bound to deteriorate with every passing year unless the Government realises and that quickly, the fundamental importance of Plant Protection as the most vital factor in their scheme of agricultural recovery and food self-sufficiency. The three-legged stool of agricultural progress can never stand stable on its two legs; all the three legs must be equally long and strong.

The Present Organisation and its Achievements: Since 1949 an organisation with 4 officers and 2 assistants in each district has been set up in this State for plant protection work. This set-up is hopelessly inadequate, considering the vast amount of work. The consolidation of even this meagre staff into an independent section, the creation of a wide and efficient network of skilled field-staff in the districts and the provision of mobile units for quick transport of men and materials are three urgent needs if the work of plant production is to expand. And it is my plea, that all these or at least a major portion of it could be done, with the resources and staff now in the department, without involving much of extra cost to the Government.

We have during the past 15 months treated about 8,000 acres against the army-worm of paddy, 2,000 acres against the green jassid of paddy, about 4,000 acres against the paddy grass-hopper, and more than 50,000 acres against field rats. Against the outbreaks of other paddy pests like *Hispa*, *Leptispa*, *Tetroda* and Rice-bug an area of nearly 2,500 acres have been tackled. In regard to millets, about 500 acres have been treated against the cholam earhead bug and more than 2,000 acres against the cholam grass-hopper. Brinjals, which is one of the staple vegetables of South India have been treated on nearly 1,500 acres and chillies in over 3,000 acres. Potatoes which are seriously damaged by cutworms and rats in the field have been treated in over 2,000 acres. Nearly 10,000 mango trees and nearly 5,000 citrus tree have been sprayed for various pests. These are only a few of the important items in the work of this section and is by no means exhaustive.

Though the above is a really creditable achievement it has but touched the very fringe of the problem of plant protection. Without a specially trained field staff in every district and without provision of mobile units for the quick transport of men and materials, plant protection can advance but little further than what we have been able to achieve so far.

The Problem of Stored Product Pests: Closely allied to the problem of crop pests and diseases in the fields is the safeguarding of the harvested produce in granaries and stores. This causes a most tremendous drain on our food reserves; it needs no emphasis or explanation since it is made so blatantly obvious to every ration card holder by the frequent issues of rations, far advanced in insect damage. Government storage centres deal only with a small portion of the total agricultural production of the country, the bulk of which is in the villages and no work has been done so far to improve the conditions here. It is an absolute necessity to strengthen this aspect of plant protection to ensure a balanced agricultural economy.

Legislative Measures as aids in Plant Protection: Before closing the subject, there is another important aspect of plant protection, namely, the role of legislative measures as aids in this work, which needs consideration. The adoption of control measures in a large area, at times of insect outbreaks is sometimes seriously impeded and very often completely obstructed by the perversity of a few isolated individuals who by their refusal to adopt any measures, lead not only to the destruction of their own crops but afford fertile centres for fresh infection. It is urgently necessary that such individuals should be prevented from indulging in this sort of unsocial acts and in Madras we have an effective instrument to prevent them in the Pests and Diseases Act of 1925. It is highly necessary and even imperative that the provisions of the above Act

should be enforced in respect of every major pest of every crop in this State. Of course such an action will be unpopular; compulsion in any form is always unpopular but it has to be resorted to for the general good and welfare of the public. The fact of having the Act promulgated does not mean that we desire to indulge in indiscriminate prosecutions and harrassments but for the field worker it is always helpful to have such a measure in the background.

A fresh legislative Act is necessary in respect of stored food products. It is agreed on all hands that stored food losses due to insects, both in quantity and quality are enormous.

It is the prime duty of the State to interfere and rectify such an obvious case of mismanagement and minimise this sort of preventible waste. At present the State is helpless to compulsorily prescribe any safety measures or enforce any standards for ensuring correct storage. It is quite essential that a legislative Act should be passed in this respect.

Conclusion: Intensive cultivation to maximise our agricultural production is an absolute necessity and will be of more and more importance to our national economy with every passing year. The efforts made so far have not had the amount of success commensurate with the expenses incurred and the labour expended. This is principally due to the non-recognition of the enormous waste caused by insect pests and diseases in the field and in the stores. In our efforts to feed our increasing millions we are but feeding increasing millions of insects and disease germs. As Sri K. M. Munshi, Food and Agriculture Minister Government of India rightly stated recently, 25% of the food production in the country is being wasted because of the carelessness of the cultivator. The easiest and quickest means of attaining food self-sufficiency is to prevent this avoidable waste, which is much larger than the actual deficit. The plant pests and diseases are our dangerous rivals for the food supplies of the world and whether we hope to survive and exist for the next 50 years will depend to a large measure upon the success or failure of a well-planned and organised plant protection service-
