Indian Farming

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Indian Farming

FEBRUARY 1959

Vol. VIII No. 11

OUR COVER

As promising as the White Leghorn for commercial egg production is the Brown Leghorn which has been recently introduced into India. With its attractive plumage, especially of the males, the breed is bound to gain popularity sooner or later

Photo by Mrs. K. Vaid

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Indian Farming

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CARE WITH CHEMICALS

MORE and more farmers are now using chemical pesticides and fungicides to get over their crop pest and disease troubles. The method does not call for much skill or financial outlay, the results achieved are quick. However, as most of the chemicals today in use are poisonous, some of them very deadly, farmers would do well to observe certain simple precautions while handling them.

It would be wise to buy only recognized, genuine packages. The concentrated product should not be transferred into other containers. It should always be stored in a locked cupboard away from edibles and fodder, and out of the reach of children and domestic pets. The accompanying instructions should be strictly followed. Only prescribed dosages should be used, and *only* for the purposes recommended.

In most cases, pesticides have to be used with certain equipments for spraying, dusting, etc. An instrument requiring sucking by mouth to draw the concentrated liquid should never be used. Clogged nozzles should not be blown into by mouth but cleaned with a thin wire. Leaky equipment should be discarded.

A rod or stick, and not the hands, should be used to mix the spray; in fact, rubber gloves should be worn. In case bare hands get into contact with the spray wash or the concentrated chemical, immediate washing with water and soap is necessary.

The operator should not smoke, eat, chew or drink while mixing or spraying. The working clothes should always be kept clean. It is better to have a wash and change of clothes after spraying.

If workers are to be employed to carry out the spraying work, only adult and healthy workers should be engaged, and *never* children or persons suffering from sores and other open wounds. Spraying should not be done at a stretch the whole day: it should be started in the morning, given up during the hot hours of the day and again resumed late in the afternoon. Spraying should be done in such a way that it is not against the wind and the operator does not get the spray mist or dust drift back on him.

The appliances should be cleaned thoroughly after the work is over. A signboard warning people should be fixed beside the field sprayed or dusted. In case of uneasiness while working, such as vomiting sensation, intestinal cramps, giddiness, etc., medical aid should be sought at once.

YOUR QUESTIONS

and

SUGGESTIONS

are

WELCOME

Address these to The Editor, "Indian Farming," I.C.A.R., Queen Victoria Road, New Delhi-2.

Love and Resolve Raise Best Khillari Herd

by

V. G. Patil-Kulkarni

"Give them love and see how they grow," says Khandve

Khandve is a successful farmer, too. He posed for me beside his bumper sugarcane crop. Left is his eldest son

WAY back in 1940, Shri Shankar Vithal Khandve of village Mahud in Sholapur district of Bombay State set his mind upon raising an outstanding herd of the Khillari breed, bought a cow and got her covered by the local pedigree bull. The idea has not proved to be just a fond hope. Today, not only does he own 40 fine specimens of the breed—ten cows, 22 heifers, five bulls and three bullocks, but was also the proud recipient of the First Prize for his "Best Khillari Herd" at the All-India Cattle Show held in New Delhi in March last year.

"The award of the prize did thrill me all right, but I've never considered it an end in itself," said Khandve, when I met him at his farm cottage recently. "To be honest to the honour given me, since then I have tried to bring my work on more scientific lines," he added. He informed me that he was now paying attention to his record-keeping; obviously, he meant milk-yield record, pedigree record, sale record, etc.

Traditional sentimental attachment to *gomata* and a constant eye on profits he expected by exporting his

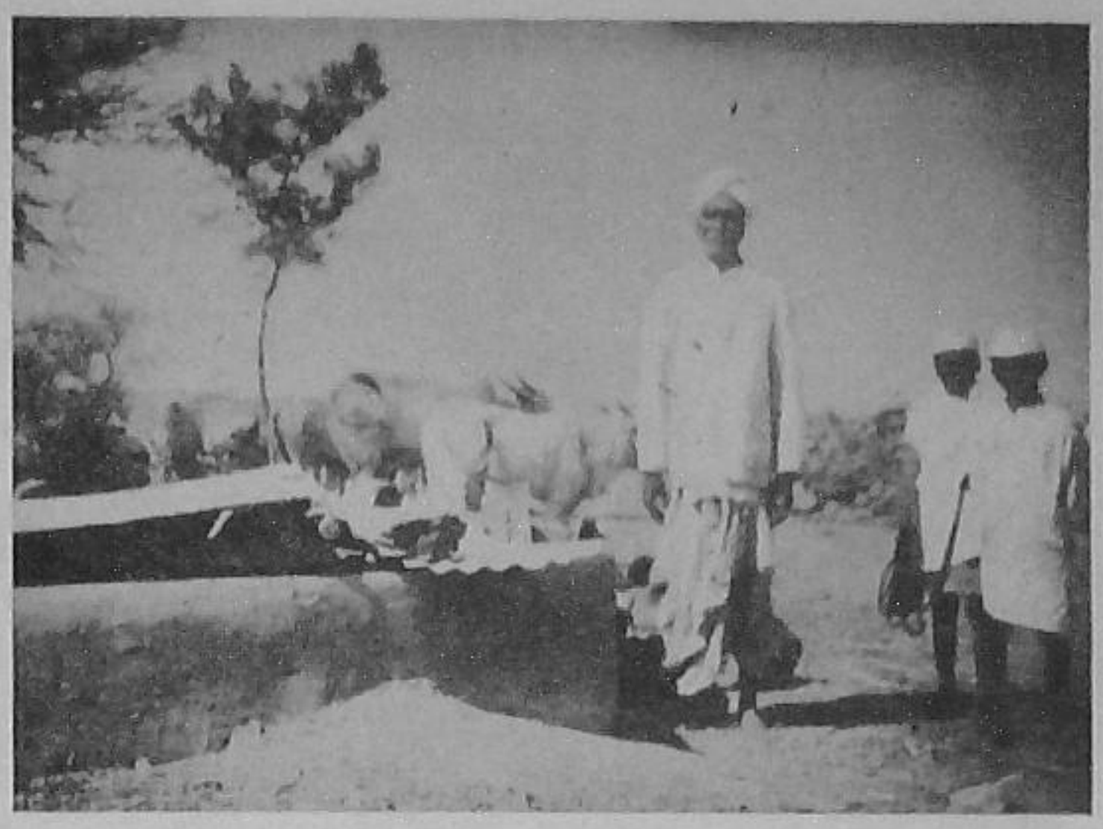
animals to countries like Ceylon and Brazil where there is a heavy demand for this sturdy breed, are what brought success to Khandve. For, whereas the first made him bestow all his love and care on the animals, the second pushed him through the hard struggle to live up to his determination in a tract where drought and famine are frequent and fodder always scarce.

NEAR-PURE BREED

Soon Khandve noticed that a number of his calves, heifers and bulls had a health and looks that distinguished them from the other animals in the village. Immediately, with advice from the Animal Husbandry Department, he took to breeding by outcrossing, and the progeny he got ultimately was a near-pure Khillari breed.

Though it is an established fact that Khillari animals are the most economic to keep and would thrive on just roughage, Khandve is not a man to take any chances. He gives each of his milch cows two pounds of groundnut cake a day mixed with an equal quantity of *matki*, wheat or gram husk. Each animal must receive ten to 15 pounds of roughage at the byre in addition to grazing. Of the 60 acres of land that Khandve possesses, 15 are reserved entirely for the grazing of animals. In summer, when the fodder problem becomes very acute, his animals get silage prepared from *jowar kadbi*, *makka*, etc.

Khandve always takes full advantage of the free services rendered by the local Veterinary Dispensary.

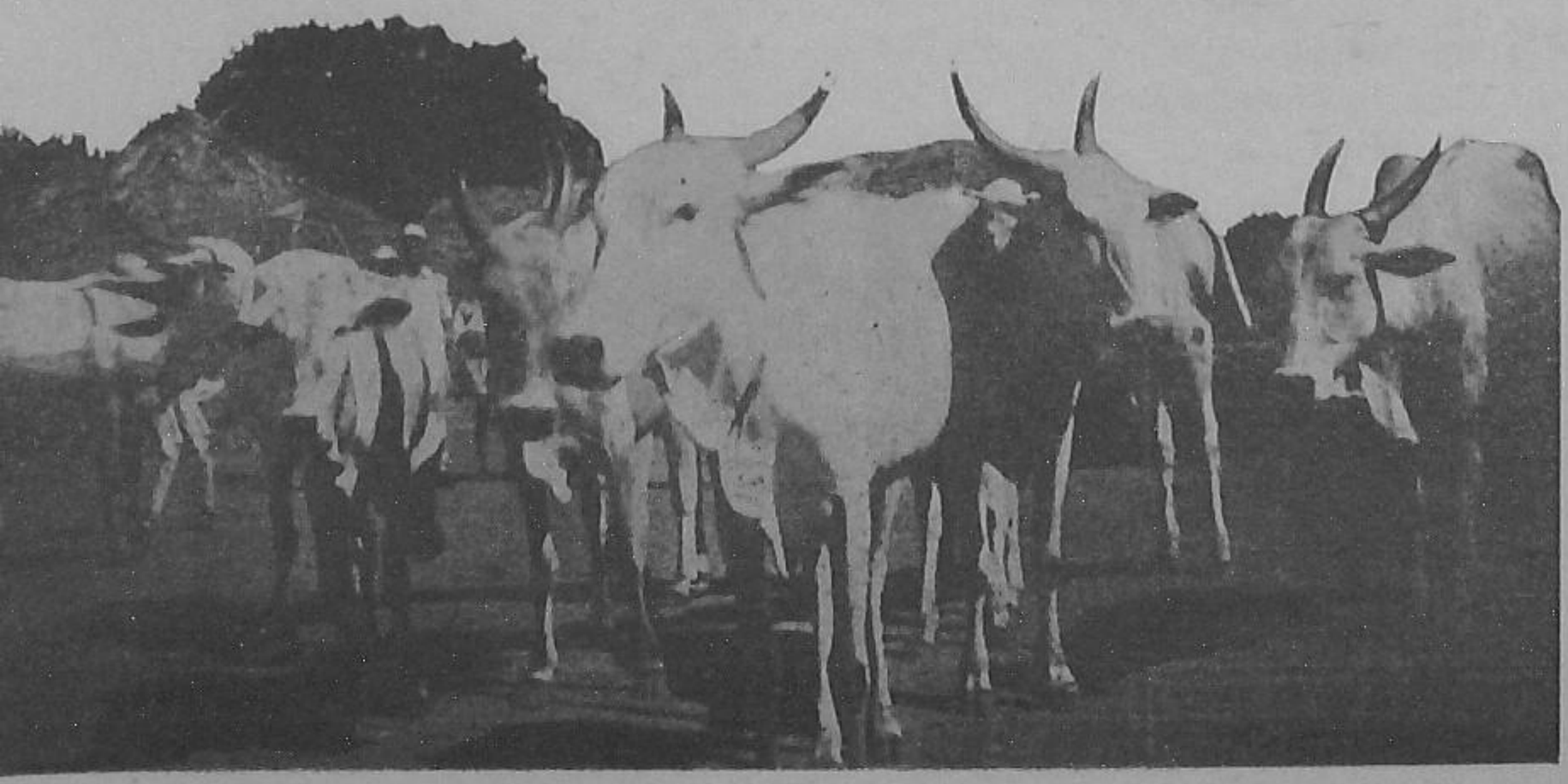


A proud possession of Khandve is this well-built silo

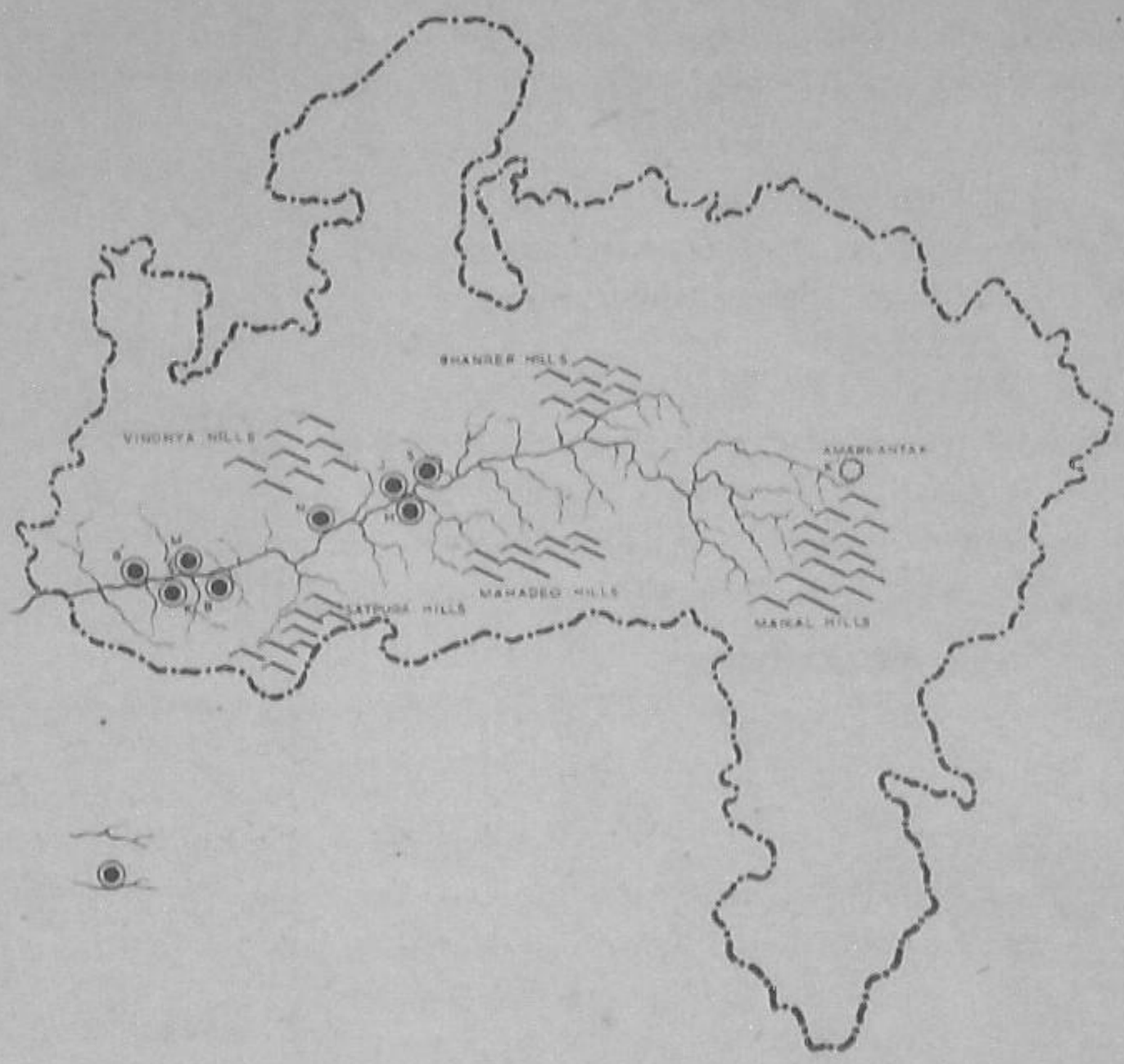
He regularly gets his herd protected against seasonal and regional cattle pests. Many of his fellow breeders are now following his example.

FULL OF PLANS

Popularly known as "master" in the area, Khandve is full of plans for the future. "I want to construct a footbath for my animals because the foot and mouth disease is sometimes a big nuisance to them," he told me. The other thing about which he appeared quite keen was the installation of a cow-dung gas plant That he is also a wide-awake farmer was revealed when he showed me the cement pipes he had bought to reorientate his irrigation system and a blueprint for constructing bunds to check soil erosion.



Khandve's 40-strong herd in paddock



For Its Fish Seed, M.P. Can Now Depend on Narmada

by

G. P. Dubey
Fisheries Development Officer
Rewa

INVESTIGATIONS over the past few years have revealed the Narmada river in Madhya Pradesh as an important source of adult table fish as well as seed of the major carps. The river also abounds in Mahseer, the mighty game-fish of the Indian waters, and its seed. What is now required is a judicious and extensive exploitation of the potential offered by the river for the benefit of pond culture in the State.

The Narmada originates at Amarkantak at 3,500 feet in the Rewa Division of Madhya Pradesh. It starts as an underspring, over which stands the holy shrine of Shivalinga. After going through a man-made stone tank it turns towards the west, and then flows between the Vindhya and Satpura ranges. It drains the entire southern slopes of the Vindhya range and northern slopes of the Satpuras. It then flows through Madhya Pradesh in the districts of Rewa, Jabalpur, Narisinghpur, Hoshangabad, Raisen, Schore, west Nimar (Khargone) and east Nimar (Khandwa), for about 800 miles, presenting a few falls, the most famous being Kapil Dhara and Sahastra Dhara, and many a rapid. It then passes into Bombay State, ultimately finding its eternal home in the Arabian Sea in the form of an estuary near Broach.

As all the fish seed requirements of the State were being met from Calcutta and Patna, in 1950, a brief survey was conducted to assess the fishery potential of the Narmada. Besides the minor fish, the river was found to have plentiful supplies of the commercial species of carps, catfish, Murrel and Mahseer, and some experimental collections showed a good percentage of the major carps among the recovered fry. Encouraged by this, efforts were intensified and very soon seed-collection centres were located and established.

The resultant fry were found to be of a fine quality and the recovery percentage was also high. Soon the

seed imports were totally stopped, saving a good bit of the State exchequer. In all, eight centres have so far been developed, and sometimes the daily yield from the centres at Nemawar, Shahganj and Khalghat goes up to 90 to 95 per cent carp seed.

The quantity and quality of the seed depends on the rainfall and flood. Maximum seed is available at the time of the second flood in July, and even the third flood in August also brings in good quality seed. The regular collection season begins in early July and lasts till the middle of September. The overall percentage of the major carps in the seed works out at 20 to 25 per cent of the total collection.

BEST COLLECTIONS

The best collections are made from shallow banks one or two miles downstream opposite to the confluence of a tributary with the main river. This is because the major carps breed in the upper reaches of the tributaries and the spawn is carried down into the river by the water current. Shallow sandy beaches formed opposite to the bends of the river are also fairly good collection sites.

The eight collection centres so far established are being regularly exploited. During 1958, nearly 60 lakh spawn could be collected and 15 lakh fry and fingerlings are expected to be raised out of them. Efforts are still being continued to localize the best collection spots and determine the best collection period so that good quality seed at low cost can be collected.

During the peak periods, as much a as 1,500 c.c. bowlful of spawn can be collected in four to five minutes. The spawn collection is done with *konamari* nets made of muslin cloth and fixed at regular alternate rows facing the water flow. The spawn is kept in small nursery pits for a fortnight or so. Such nursery pits are provided at all the centres.

In addition to being that of *Catla catla*, *Labeo fimbriatus*, *Labeo calbasu* and *Cirrhina mrigala* the resultant fry also contains small quantities of the minor carps. The unwanted varieties are sorted out and the carp seed is either put in rearing tanks or directly stocked in stocking tanks. The surplus is transported to seed-deficit areas in plastic bags under oxygen pressure.

During the First Plan period, a total of 7½ lakhs of fry and fingerlings was recovered at the Narmada centres in the Indore Division. Subsequently, the number increased to 8½ lakhs in 1956-57, 11 lakhs in 1957-58 and 15 lakhs in 1958-59 from all the above centres.

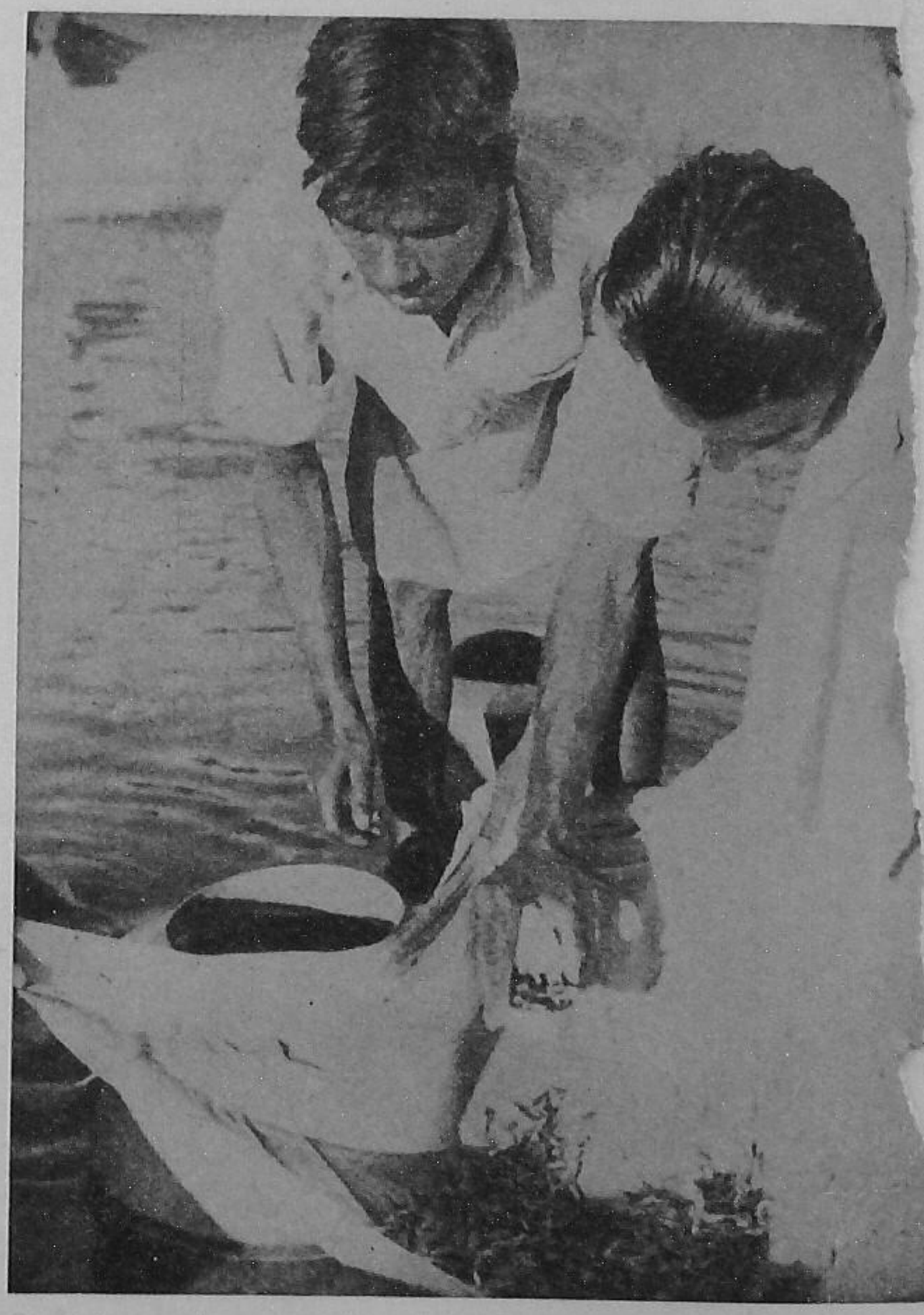
VALUABLE VARIETY

It is interesting to note that *Labeo rohita* had so far been absent in the Narmada, but as a result of the release of stock-fish from some tanks in Indore and Jabalpur Divisions, this valuable variety has also been introduced. The catches of adult Rohu at Hoshangabad and Onkareshwar and also at Jabalpur show that the fish has acclimatized and is growing well. Already small quantities of its seed are found among the spawn collections, and in a few more years large quantities of

Mahseer fry recovered from the Narmada

it are anticipated. The Narmada Rohu *Labeo fimbriatus* occurs in good quantities, so also ts seed. It has been found to attain a size of ten to 12 pounds in three to four years in stocking tanks.

At the close of the carp spawn collection season, which is quite a long one, the muddy river clears up, and this is the time for Mahseer to breed. The breeding takes place by the end of September, and is over by the middle of October. The September breeding is the third breeding, as Mahseer is known to breed in January and June-July also.



Counting the catch

The breeding is more intense during the September-October period. On the sunny days of October and November, hordes of young ½ to 1½-inch Mahseer fry are seen playing briskly in the shallow rapids formed by small pebbles. These tiny, active fry can be easily collected with a rectangular piece of mesh cloth.

Konamari **nets have been set to trap the fry**

An improved type of net with a central cone-like bag and laterally extended wings is also used, as it covers a wider area and gives better results. Some leaves and twigs are tied to a rope and this contraption, called the "scare-line," is moved across the water. Two men stretch it from corner to corner and drag it in a semi-circular fashion, shaking the rope every now and then. The tiny fry are thus driven in front of the net which is also operated simultaneously.

THE DAY'S HAUL

A full day's haul, by working between 11 a.m. and 4 p.m., yields about 10,000 to 15,000 fry. The Mahseer fry are very hardy and can stand the stress of long-distance transport. The weaklings are weeded out by conditioning in mesh *happas* kept in a shallow current. The work of fry collection is done through private parties of fishermen and the seed thus procured costs three to five rupees for a thousand.

This natural treasure of Madhya Pradesh has been well utilized and pond culture of Mahseer is also being advocated along with that of the major carps. Mahseer grows to six to eight pounds in 2½ to three years, and this is very satisfactory. During 1956-57, over two lakhs and during 1957-58, five lakhs of fry of Mahseer were collected and stocked in the tanks of Madhya Pradesh.

The seed potential of the Narmada is very high and it has already fully met the seed requirements of Indore and Bhopal divisions. In addition, seed was also supplied to the Mahakoshal region in 1958-59. It is hoped that in the next few years it would be possible to meet the entire seed requirements of the State, and probably of some of the neighbouring states as well.

The picturesque Sahastra Dhara fall at Maheswar in W. Nimar district

Irrigation channels provide an ideal roam for the birds

Towards More Duck Eggs, Better Returns to Producer

by

P. Seshadri Sarma

and

K. Janardana Rao

Andhra Pradesh Department of Agriculture, Hyderabad-Dn.

THE delta districts of East Godavari, West Godavari, Krishna, Guntur and Nellore of Andhra Pradesh produce annually about 225 lakhs of duck eggs, valued at nearly Rs. 18 75 lakhs. Of these, only ten per cent are consumed within the State, leaving a large surplus for export, mostly to Calcutta. These delta districts of the State have over 30 lakhs of acres under paddy with assured irrigation, and the swamps provide ample natural feed for the ducks in the form of shed grain in paddy fields, snails and insects and larvae. With proper measures, the present production of duck eggs in this tract can be increased considerably, and the need to import over twelve crores of eggs annually, valued at over one crore of rupees, from East Pakistan done away with.

Except for a few individuals engaged in duck breeding in the *kolleru* area of West Godavari district, there are no regular duck breeders in this tract. The ducklings for rearing are generally obtained from Conjeevaram, Arkonam, Wallajah Road, etc., of Madras State at Rs. 250 per 100 birds, including transport charges of Rs. 25 on the average.

To keep down the cost of maintenance and to increase the margin of profit, the birds are allowed to roam about freely and fetch their own feed. Weather conditions and the cropping pattern in these districts necessitate the shifting of birds from place to place according to the availability of the feed. When long distances are involved, the birds are transported in lorries in specially designed cages. Thus the flocks will be found roaming about in the wet land areas of the Godavari delta and Krishna district from November to the middle of February, feeding on the shed grain, insects, larvae, etc., in the paddy-growing areas of Nellore district from February to June, and in the wet land area of Guntur district from July to October. But so far as the *kolleru* area is concerned, the continuous swampy conditions there make the rearing of these birds possible from November to the end of June.

The birds are maintained in flocks of 300 to 400, which forms a unit. Each flock will have eight to ten per cent male birds, also known as drakes. Though for the production of table eggs it is not necessary to maintain the drakes, the duck rearers consider them

And, harvested paddy fields enough shed grain for food

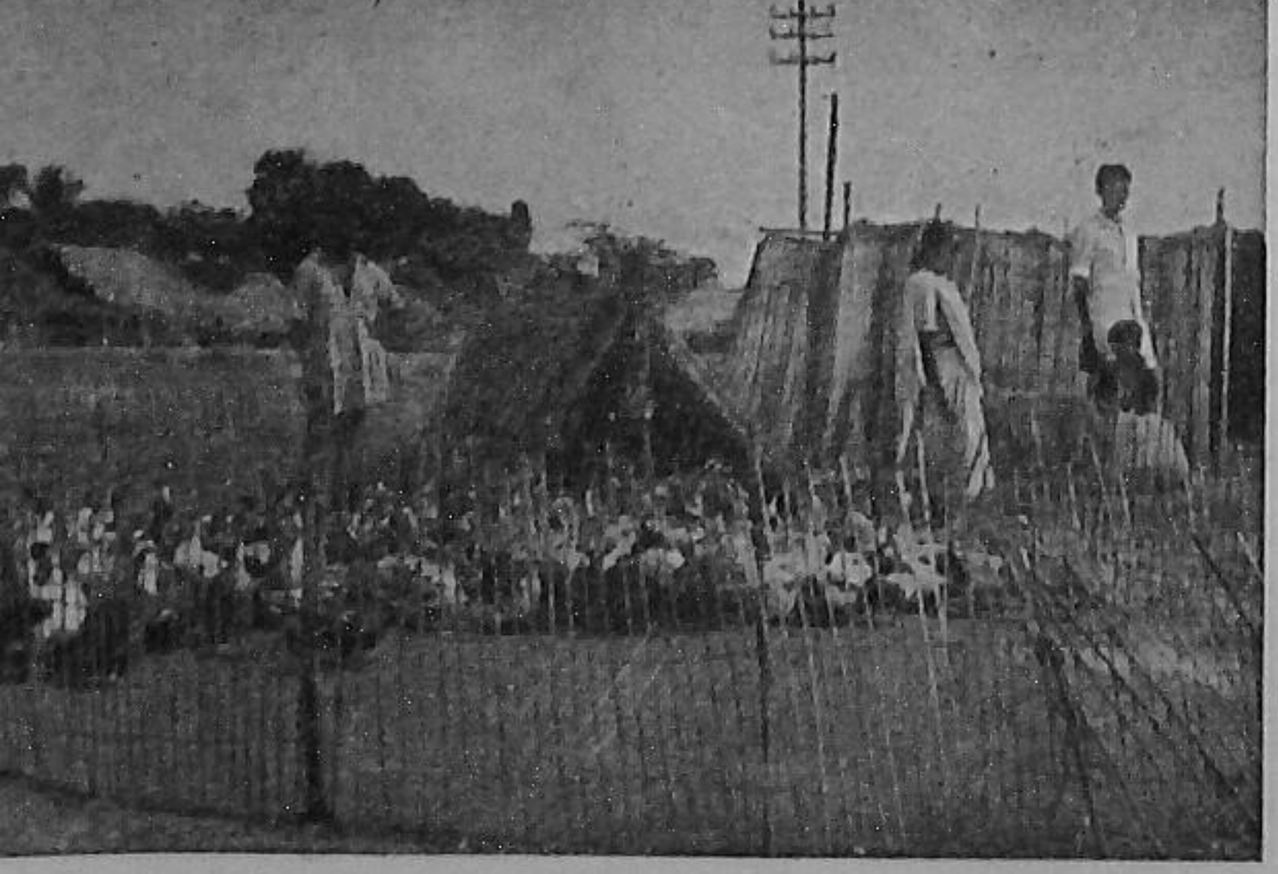
necessary for the health of the ducks and for increased egg production.

On the average, a single duck lays about 120 eggs in a year in the first two years of laying. The egg yield goes down to 80 in the fifth or sixth year. With proper feeding and management, a good layer can be expected to yield 150 eggs in a year.

The birds return to the enclosures at nightfall. Each enclosure accommodates one unit. The enclosures are provided with a thick layer of straw to keep the birds warm, to serve as a bedding for them and to prevent the eggs from getting soiled.

Ducks lay eggs at about 2 a.m. The flock owners collect the eggs very early in the morning, long before sunrise. The collected eggs are kept in a cool place before they are taken to the assembling centres for sale.

In enclosures such as this the birds are housed for the night



The strong pungent smell of the duck egg stands in the way of its larger demand from within the State. But in West Bengal, where there is a sentimental objection to consumption of hen eggs, duck eggs are in great demand. This accounts for the export of large quantities of duck eggs to the Calcutta market.

ASSEMBLING CENTRES

The assembling centres for duck eggs are Anaparthi, Rajahmundry and Medapadu in East Godavari district, Akiveedu, Bhimavaram, Tadepalligudem, Eluru, Veeravasaram and Palacole in West Godavari district, Kaikalur in Krishna district, Repalle and Tenali, etc., in Guntur district and Nellore. Tadepalligudem and Rajahmundry being situated in the heart of the producing area and also being on the main railway line have become important exporting centres.

Egg baskets are transported to the assembling centres and from there to the railway stations on buses.

Maintaining of duck flocks is mostly taken up as a wholetime job, only about ten per cent of flock owners being cultivators. The assembling merchants (who are also exporters) at the above centres purchase the eggs from the producers, mostly at their own premises. But when the supply is short, they send their agents to the villages. These exporters keep in constant touch with the commission merchants who keep them informed about the prices prevailing in the Calcutta market. The prices are quoted per hundred eggs, irrespective of their size.

FINANCIAL ASSISTANCE

About half of the egg producers take financial assistance from the assembling merchants by way of cash advances. They are then obliged to sell their produce to them at rates lower by 25 to 50 nP than the ruling rates, depending upon the period of advance. The

period of advance generally ranges from three to six months.

The eggs purchased by the merchants are packed in baskets, using sufficient clean paddy straw as packing. Each basket holds 300 eggs and weighs about 25 seers. Necessary precautions in packing are taken to ensure safe transport by train. Ninety per cent of the stocks are sent on consignment basis to the Calcutta market. About ten per cent are purchased by a few Calcutta merchants operating at Kaikalur, Akividu and Bhimavaram on cash payment.

The baskets received at the other end are sold by commission merchants to retailers and large establishments like hotels. The baskets are mostly sold without opening. Only when damage in a basket is suspected that it is opened and sold. The sale is by negotiation. The commission merchant sends the money due to the exporter immediately after sale, after deducting his commission and other expenses. Ordinarily, money is received within a week of the date of despatch. In the retail trade, the eggs are cleaned and sorted for eliminating the stale and broken ones.

A specially designed cage for transporting birds in lorries

Marketing costs vary with the manner in which the consignment is booked to Calcutta, i.e., whether it is sent by express or passenger train, or despatched in a direct train or sent to some intermediary station and thence rebooked to Calcutta. The assembling merchants normally get a profit of about nine per cent. Consignments booked by direct train (express) from Tadepalligudem fetch higher prices.

PROBLEMS OF INDUSTRY

Production: Duck-rearing has become a specialized type of farming in this tract, but breeding, feeding and management of these birds is not on scientific lines. The birds do not belong to any specific breed. Therefore, the immediate need is for a research station for evolving a breed of high-laying capacity suitable for the tract, and for finding out better methods of duck feeding and management.

Quality: Fertile eggs do not keep in good condition for long periods. The transport from the production centres to the consuming market takes a long time and the chances of the quality going down, and even spoilage, are high, more so during the summer months. Production of infertile eggs for export, therefore, should be encouraged.

Dirty and stained eggs fetch lower prices. Since washing hastens spoilage, production of clean eggs by providing abundant floor space to the birds during the nights and spreading sufficient litter on the floors of the enclosures, needs to be stressed.

Grading: At present, the eggs are sold without any kind of grading. The prevailing prices in the Calcutta market are quoted irrespective of the size of

the eggs. But the retailer in Calcutta sorts the eggs before selling.

More than 70 per cent of the eggs received in bulk at the different assembling centres in this area fall under the first two grades, "Extra large' and 'Large," as per Agmark specifications. The rest fall under the third grade, "Medium," and generally very few go under the last grade, "Small." Thus, if the producer gets his eggs graded before selling he will get a higher return. Compulsory grading of eggs will have to be enforced so far as the export trade is concerned.

Transport: Apart from producing the right kind of eggs, it is highly necessary that they are so handled as to make them available to the consumer with the least possible loss of quality.

Till recently, unrestricted direct booking of duck eggs from all the rail-heads in Andhra Pradesh was

Egg baskets securely held on bus-tops for transport

available. But at present the Southern Railway has restricted the direct booking and only limited quantities are booked direct to Howrah on a quota basis from each station. The exporters are moving the remaining stocks by booking to Waltair in the first instance and then rebooking to Howrah. This is entailing an appreciable amount of additional expenditure and also resulting in abnormal delays. Consignments despatched by express train fetch 50 nP to a rupee more per 100 eggs in the Calcutta market, as these reach there comparatively fresh.

There are no special arrangements in the railway brake vans to accommodate the egg baskets. These are piled one upon the other in a crowded manner, the topmost one almost touching the ceiling of the van. It is highly necessary that an E.V.P. (Empty Ventilated Parcel) waggon should be provided for the transport of eggs. This waggon should be attached to the Hyderabad-Howrah Express daily at the Tadepaligudem railway station during the peak season (November to February). The waggon should be provided with shelves to keep the egg baskets. A refrigerated waggon would solve the problem fully.

Freight rates: About 12 per cent of the price realized in the Calcutta market is spent towards the freight charges alone. The consignments are being charged at half parcel rates at present. As the eggs are as much perishable as fruits, the concession of one-fourth parcel freight rate allowed to fruits may be extended to eggs also.

Movement of birds by train: To facilitate easy movement of ducks from place to place at minimum cost, priority should be given to booking of baskets of ducks by passenger trains.

Storage facilities: Cold storage plants may be established for storing duck eggs. Cold storage of this product and regulated sales will make it free from the effects of seasonal gluts in the market, restrictions imposed in booking by the railway and high temperatures during summer.

Better marketing: To improve the lot of the producers, it is necessary that co-operatives enter into the field of financing the producers and in assembling and marketing the eggs. The co-operatives may also aid the producers in the transport of birds.

Grading of duck eggs would bring the producer more profit

The filling has reached the ground level

SILO THAT SURPLUS FODDER

by

K. Kandaswamy
and
N. Ramaswamy
Livestock Research Station
Hosur

A GOOD substitute for green fodder during the difficult days of summer is silage. Silage is nothing but surplus green fodder, when it is available in plenty during the months of October and November, saved in silos for future use. If preserved in the proper way, unlike hay, silage does not lose in quality even after five years, it has been seen at the Hosur Cattle Farm. Most fodders and all grasses and surplus pasture, except legumes like lucerne, berseem and sannhemp, can be made into good silage.

Silage-making has many advantages over hay preparation. The succulent condition of the green fodder is maintained, and the product gets the smell of wood-apple which is liked by animals when they get used to it. The crop can be harvested at an early stage of maturity, there is no need to wait for ideal weather, and there are no curing problems. The cost of preparing silage is low.

The process of siloing or ensiling, as it is called, has developed greatly in countries where the weather may not always be kind for the making of hay, or where large quantities of green succulent feeds are required for the cattle during winter. In those countries, different types of silage are formed in constructed towers, but for our conditions ordinary pit-silos are quite suitable.

DIGGING PITS

Pits may be dug on a high-lying portion of land, so that there is no seepage into them. The size of the pit would depend on the fodder available for ensiling. It may be roughly calculated on the basis that every cubic foot will hold 50 to 55 pounds of green fodder. Even a same-size pit will hold more of a fine fodder such as grass, than of a coarse fodder such as *cholam* or teosinte. The depth of the pits can be even 12 to 15 feet if the water-table is sufficiently low. Too small pits should be avoided as then there is more of surface contact and more spoilage. Circular pits are better than rectangular ones because they have comparatively less of surface contact. It is worth-while bricklining the sides of the pits to reduce spoilage along the sides.

Before filling them, the pits are thoroughly cleaned and padded with dry straw or hay all along their sides and on the bottom to prevent fodder coming into direct contact with the earth. Care is taken to see that the padding along the sides is perfect, as any air-pockets left will lead to mould formation and decomposition. Green fodders after harvesting are dumped into the pits and spread evenly on the bottom. The best time for harvesting a fodder for ensiling would be when the crop has just started flowering.

FILLING

It would be better to chaff the fodder before ensiling ; there will be less wastage. If the fodder is found in a withered condition due to a bright sun, it may be sprinkled overwith water at one or two gallons for every 1,000 pounds, as the need may be, after dumping it into the pit.

Molasses and salt are added at the rate of a pound each for every 1,000 pounds of fodder ; the quantity of molasses can be increased to even ten pounds, depending on availability. When the filling is just approaching the ground level, heavy animals like Sindhi bulls or buffaloes may be allowed in to trample over it to secure a thorough packing.

When the filling reaches the ground level, further layers of fodder are arranged more evenly. In this way, it is taken to a height of ten to 12 feet above the ground level and given the shape of a dome on the top. With the sinking down of the material, fodder may bulge out; such portions should be chopped off to allow the whole mass to go down properly. The top and the sides may then be covered with some waste fodder or weeded grass and plastered over with mud.

The whole process of filling takes eight to ten days. The process should not be carried out with any undue haste, nor a long time taken to do it. Any cracks formed due to the further sinking down of the material should be closed with earth. Once the pits are closed, they should be kept air-tight till they are opened for taking out the silage.

Filling of a silo in progress

REMOVING SILAGE

The silage will be ready for feeding in about three months. Once the pit is opened the contents should be used up as quickly as possible to avoid wastage and drying up. The best thing would be to remove a third or a fourth of the top portions of the pit by cutting straight to the bottom with a hay or silage knife. Similarly, another one-third or one-fourth portion may be taken out when needed. This would considerably avoid drying of the silage. The total wastage and dryage would vary from 15 to 35 per cent, depending on the nature of the fodder ensiled and the weather conditions at the time of ensiling.

Given below is the cost of ensiling 3,20,000 pounds of fodder in a pit 36 ft. x 20 ft. x 8 ft.

	Rs.
Labour charges by way of loading, carting, and filling fodder, and covering the silo	180.00
Cost of molasses : 300 pounds at 0.03 per pound	9.00
Cost of salt : 300 pounds at 0.03 per pound	9.00
	198.00
or	200.00
Cost of preparing a 100 pounds of silage	0.06

It's Sure Economical to Fertilize Linseed

by

A. R. Khan *and* **G. P. Gupta**
Indian Agricultural Research Institute
New Delhi

RECENT studies at the Indian Agricultural Research Institute, New Delhi, have clearly shown that the linseed crop yields better if given nitrogen.

Linseed happens to be one of the five major oilseed crops of India, and is extensively grown in Madhya Pradesh, Uttar Pradesh, Andhra Pradesh and Bombay. It is mainly cultivated for the seed which is either exported or pressed for oil. Linseed oil finds great use in the varnish and paint industries. The average yield of linseed in India, however, is very low. In view of the important position that it occupies in the export trade of the country, it is essential that its production should be stepped up.

The variety used in the experiments was *RR9*. Nitrogen at 30 and 60 pounds per acre was tried. The fertilizer used was ammonium sulphate, and the doses one maund and 35 seers and three maunds and 30 seers. It was found that the yield in the first case increased by 37.8 per cent (4.78 maunds) and in the second case by 59.7 per cent (7.07 maunds), compared with no-fertilizer treatment. However, there was a decline in response when the dose was increased.

Linseed is a crop with a low nutrient requirement. It removes less nutrients from the soil per acre than does wheat. Under Delhi conditions, it does not respond to phosphorus and potash application, so nitrogen seems essential for it.

From the economics point of view, the 30-pound treatment gave a net increased return of Rs. 90.68 and the 60-pound treatment a net increased return of Rs. 121.07, over no-fertilizer treatment. The price of linseed has been taken as Rs. 24.75 per maund and that of ammonium sulphate as Rs. 14.00 per maund.

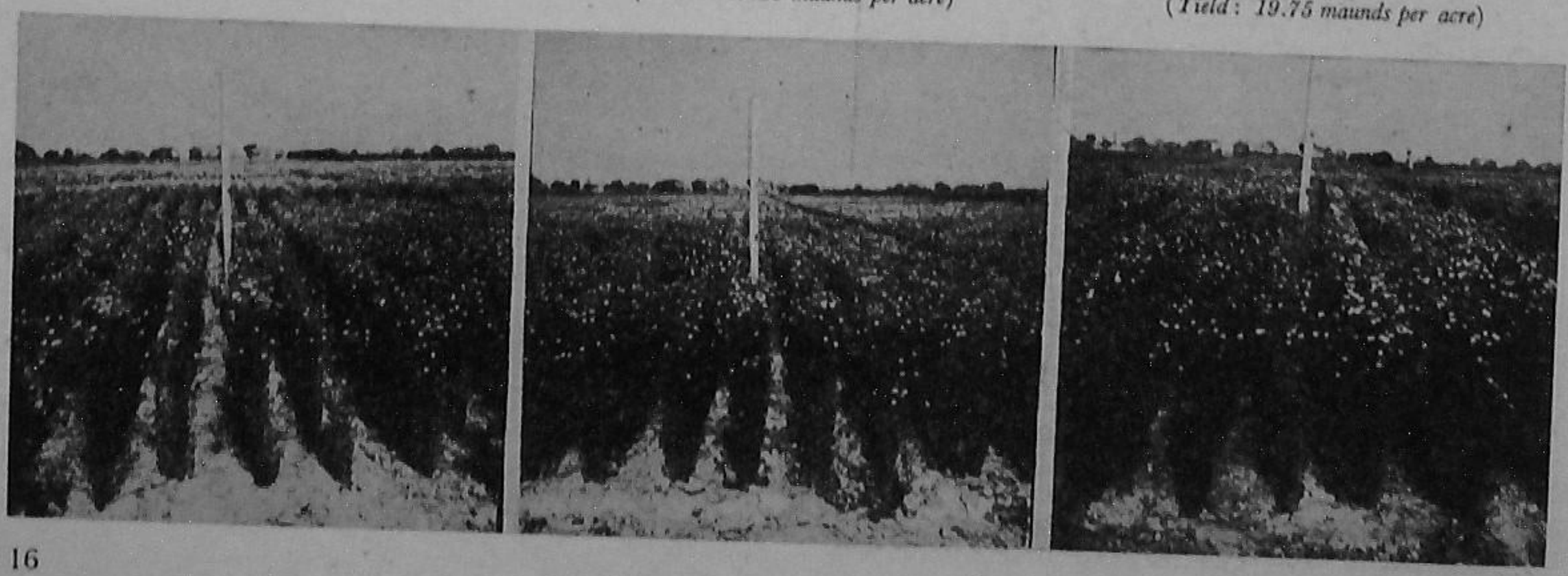
Nitrogen at 60 pounds per acre was found to be the most economic and remunerative dose with irrigation in the alluvium tract in a double-cropping pattern. When linseed preceded fallow, it did not respond to a high dose of nitrogen and the optimum requirement was found to be 30 pounds. Fertilizing linseed, therefore, is a sound and economic practice.

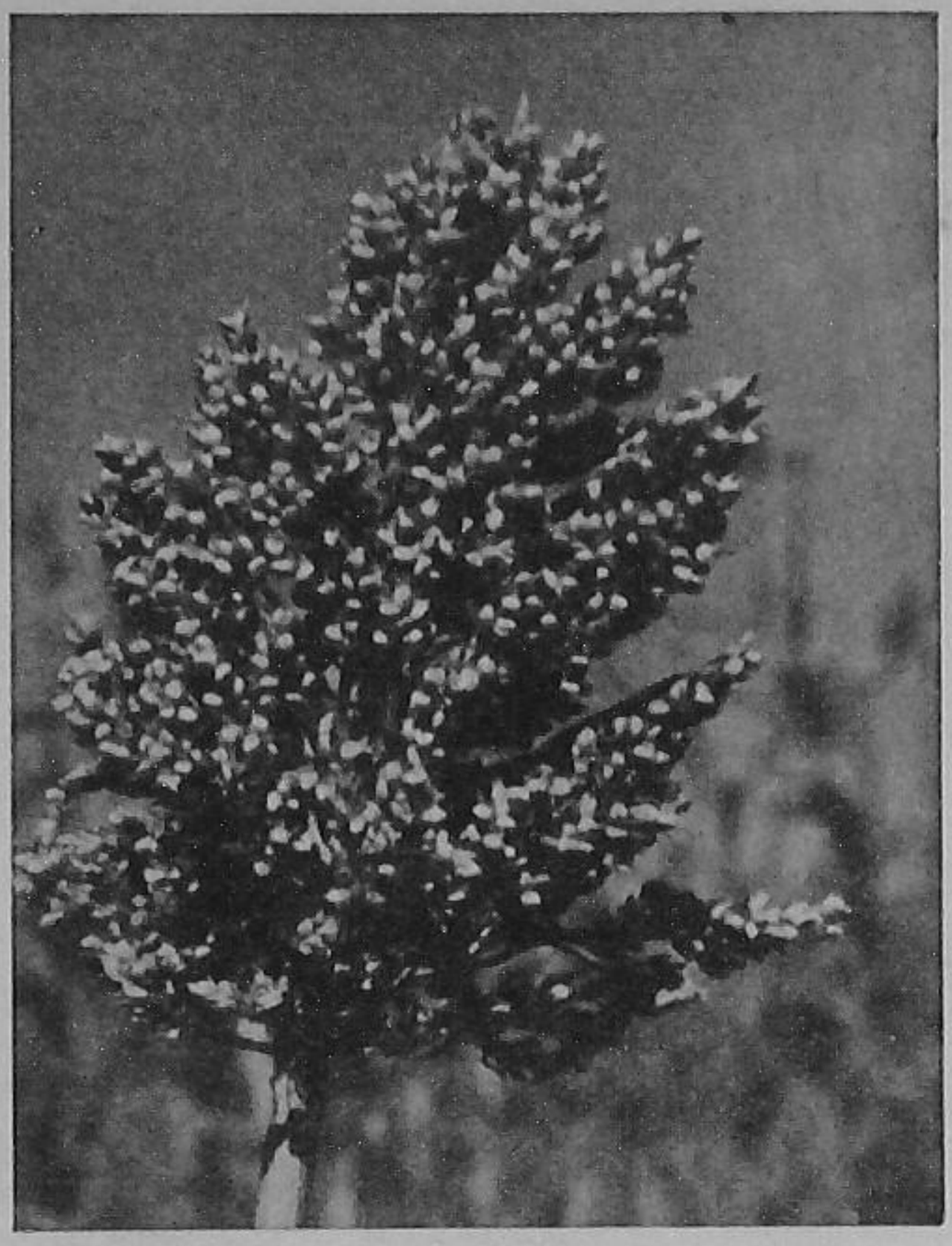
Linseed grown with...

...no nitrogen
(*Yield: 12.68 maunds per acre*)

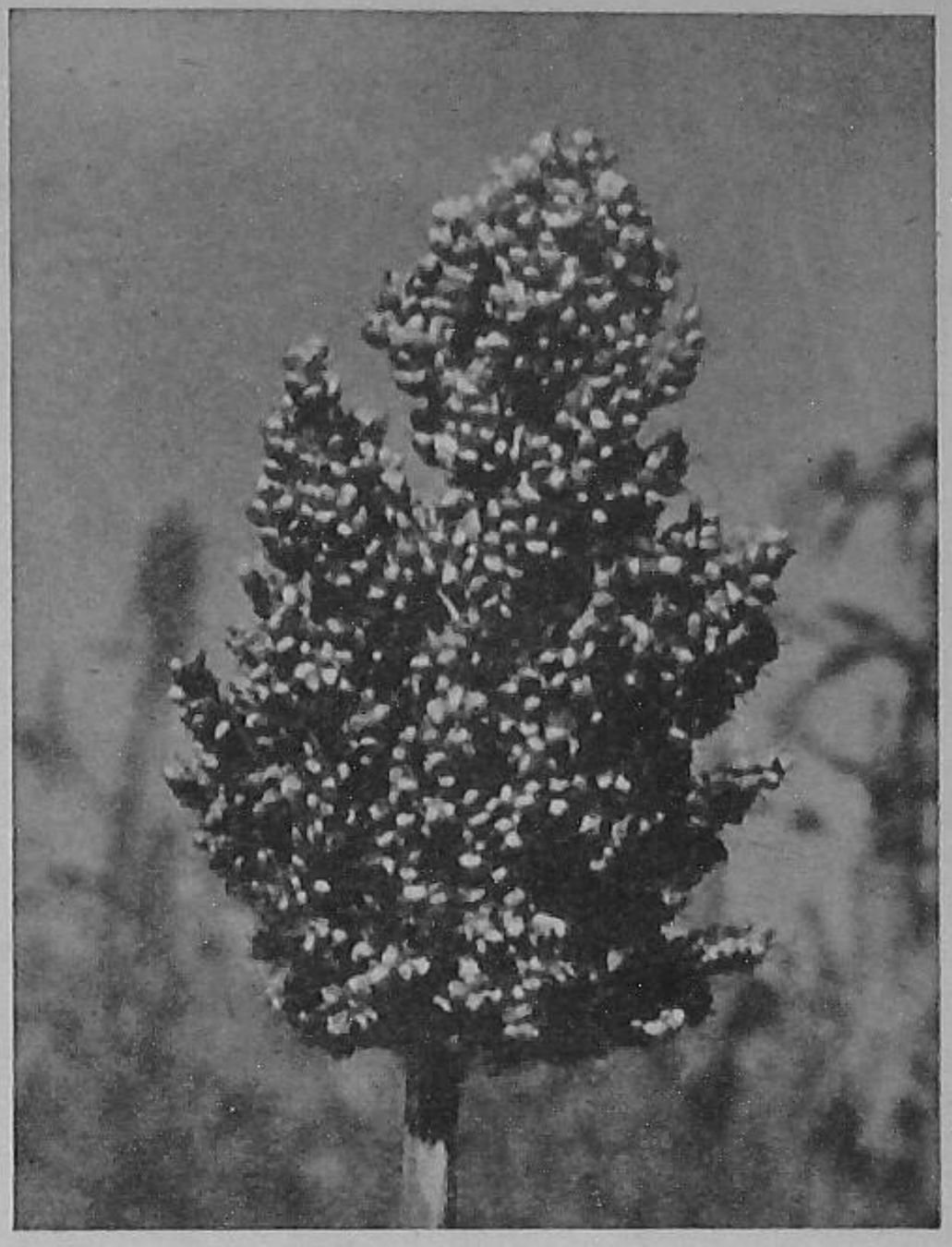
...30 pounds nitrogen
(*Yield: 17.46 maunds per acre*)

...60 pounds nitrogen
(*Yield: 19.75 maunds per acre*)





Gwalior 304



Gwalior 82

TWO NEW JOWARS

for Madhya Pradesh farmers

TWO new varieties of *jowar* are now available to farmers in northern Madhya Pradesh. They are *Gwalior 304* and *Gwalior 82*.

In northern Madhya Pradesh, *jowar* is grown on 6,76,000 acres giving an outturn of 1,66,000 tons. The two new varieties are specially recommended for Gwalior, Bhind, Morena and Datia districts. The soils of this region are light, comprising sandy and clayey loams. Both the varieties are tall and vigorous-growing, and superior in grain quality and yield compared to the existing local and recommended varieties.

GWALIOR 82

It is a yellow-grained variety with semi-compact panicles. The glume colour is brown. The grains are bold, the weight of a 1,000 grains being 34.0 grams. The average grain yield is 750 to 900 pounds per acre. The crop takes 110 days to mature.

GWALIOR 304

This is a variety with bold, chalky-white grains which are very attractive. The panicles are lax. The glume colour is brown. A 1,000 grains weigh 34.0 grams. The average yield of grains is 750 to 900 pounds per acre. The crop ripens in 120 days. This variety is very easy to thresh.

—S.M. Wakankar and C.N. Mahadik

Not only better tobacco, but

15 per cent more tobacco

if you "place" fertilizer with this implement

by

N. R. Bhat

and

K. Kameswar Rao

Central Tobacco Research Institute
Rajahmundry

DEEP placement of fertilizer, whether only nitrogenous or complete (N, P and K), has been found to increase the yield and improve the leaf-quality of flue-cured Virginia (cigarette) tobacco in Andhra Pradesh. Such an application has raised the cured leaf and bright leaf yields by over 15 per cent at the Central Tobacco Research Institute, Rajahmundry. Keeping this fact in view, a simple bullock-drawn implement has been devised at the Institute to meet the needs of tobacco growers for deep placement of fertilizer.

The rain-fed flue-cured Virginia tobacco grown in Andhra Pradesh develops a deep root system. This enables it to feed in the subsurface zone containing adequate moisture required for the absorption of nutrients during the active period of its growth. Naturally, therefore, a much better response results when fertilizers are placed at a depth of about six to nine inches in the subsurface zone.

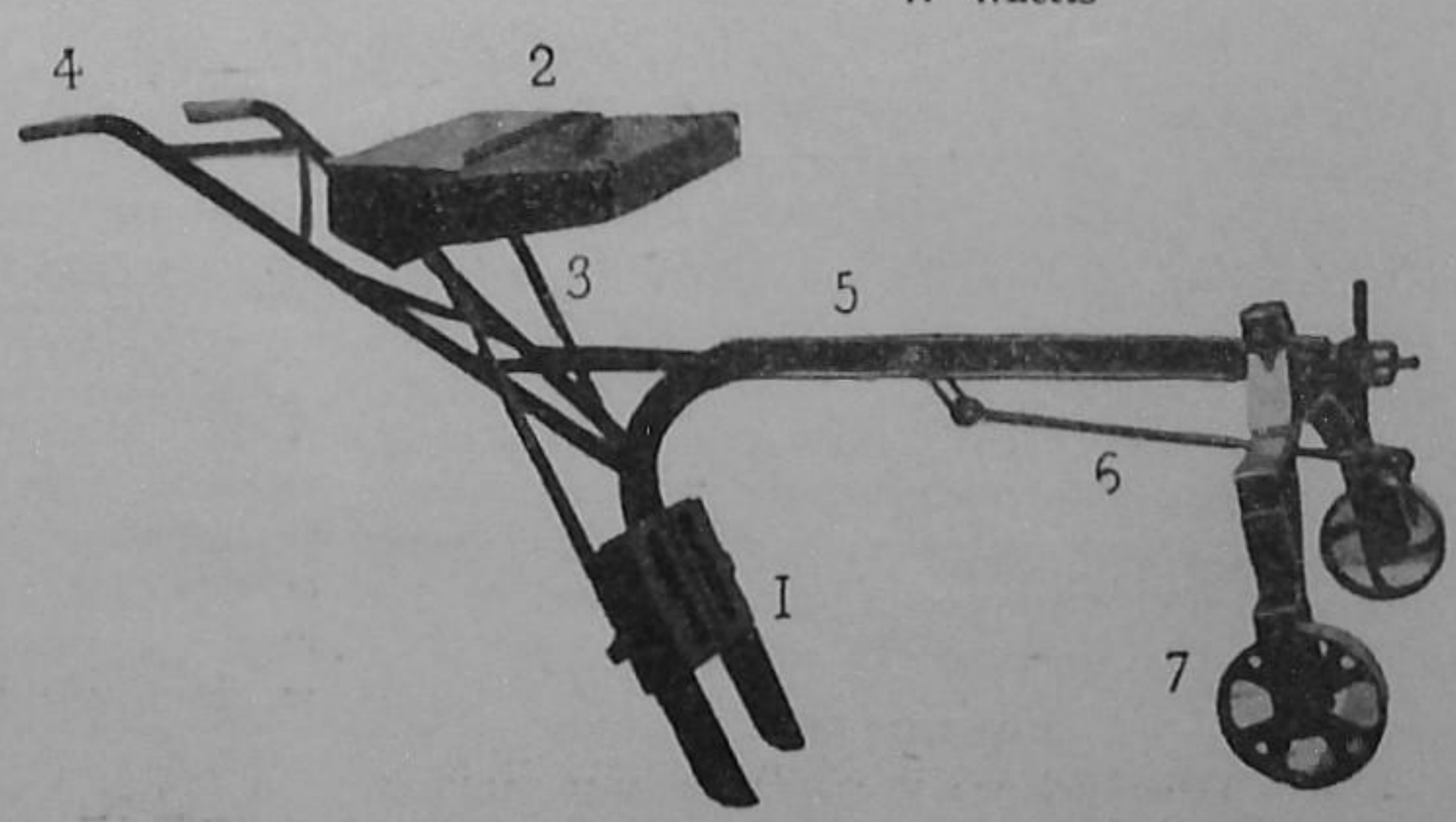
TWO ASSEMBLIES

The implement, named the "Deep Fertilizer," consists of two assemblies: a rear assembly comprising the deep fertilizer, a hopper for the fertilizer, two fertilizer-dropping tubes connected to the bottom of the hopper, and operating handles for the implement; the yoke assembly in the front comprising a central beam, a central tie-rod for hitching the implement to the yoke to which are attached two wheels, one on either side, for steadying and guiding the implement.

The deep fertilizer in the rear assembly has two solid heavy rectangular welded steel housing blocks securely connected by bolts and nuts to either side of the central beam. To these blocks are attached the two soil-cutters which are also of mild steel bars of $2\frac{1}{2}$ inches $\times 1\frac{1}{2}$ inches sections and 17 inches long with profiled cutting edges at the bottom.

Just above the central beam, in front of the two wooden handles, is the hopper or the tray made of thin, galvanized iron sheet for holding the fertilizer. The hopper consists of two chambers with a sliding, vertical partition in the centre. In one of the chambers, a measured quantity of the fertilizer sufficient for a certain number of rows is put. The second, the feeding chamber, has two openings provided at the bottom, to which are connected by means of welded couplings two one-inch diameter tubes for dropping the fertilizer. These tubes are firmly clamped to the hind side of the two soil-cutters. Here, special mention may be made of the fact that the lower ends of the tubes are purposely

1. **The deep fertilizer**
2. **Hopper**
3. **Fertilizer-dropping tubes**
4. **Operating handles**
5. **Central beam**
6. **Tie-rod**
7. **Wheels**



kept above the soil surface to prevent the tubes from getting clogged or obstructed by the soil.

SIMPLE WORKING

The implement is used when the soil is fit to receive the fertilizer for the tobacco crop: this is either at planting time or earlier up to a month prior to planting. It works in a simple manner, like a plough, with the power of only one pair of bullocks. The soil-cutters secure two deep soil cuts of at least six inches. A cut of up to nine inches can be secured and maintained by applying weight to the implement. This may be done by placing on the beam, at the foot of the handle, one or two small sand-bags.

When the cuts are being made, the farmer drops the required quantity of fertilizer into the feeding chamber with his hands. The fertilizer passes down the tubes and drops instantaneously at the bottom of the deep cuts, closely behind the soil-cutters, before the cuts are covered by loose soil from the sides.

AT REQUIRED DEPTH

Thus, the implement secures placement of fertilizer at the required depth of up to about nine inches in parallel lines on either side of the planting strip. When, later on, the crop row is planted along the centre of the strip, it will have the fertilizer lines six inches away on either side.

The Deep Fertilizer was tried successfully for flue-cured Virginia tobacco on the Rajahmundry Institute farm in the year 1957-58. The soil on which the crop was grown was heavy, black cotton soil, containing about 60 per cent clay. The fertilizer was placed at a depth of about six inches, the depth having been secured and maintained by weighting down the implement with sand-bags. This was done about a week before planting when the surface soil was dry and suitable for the operation.

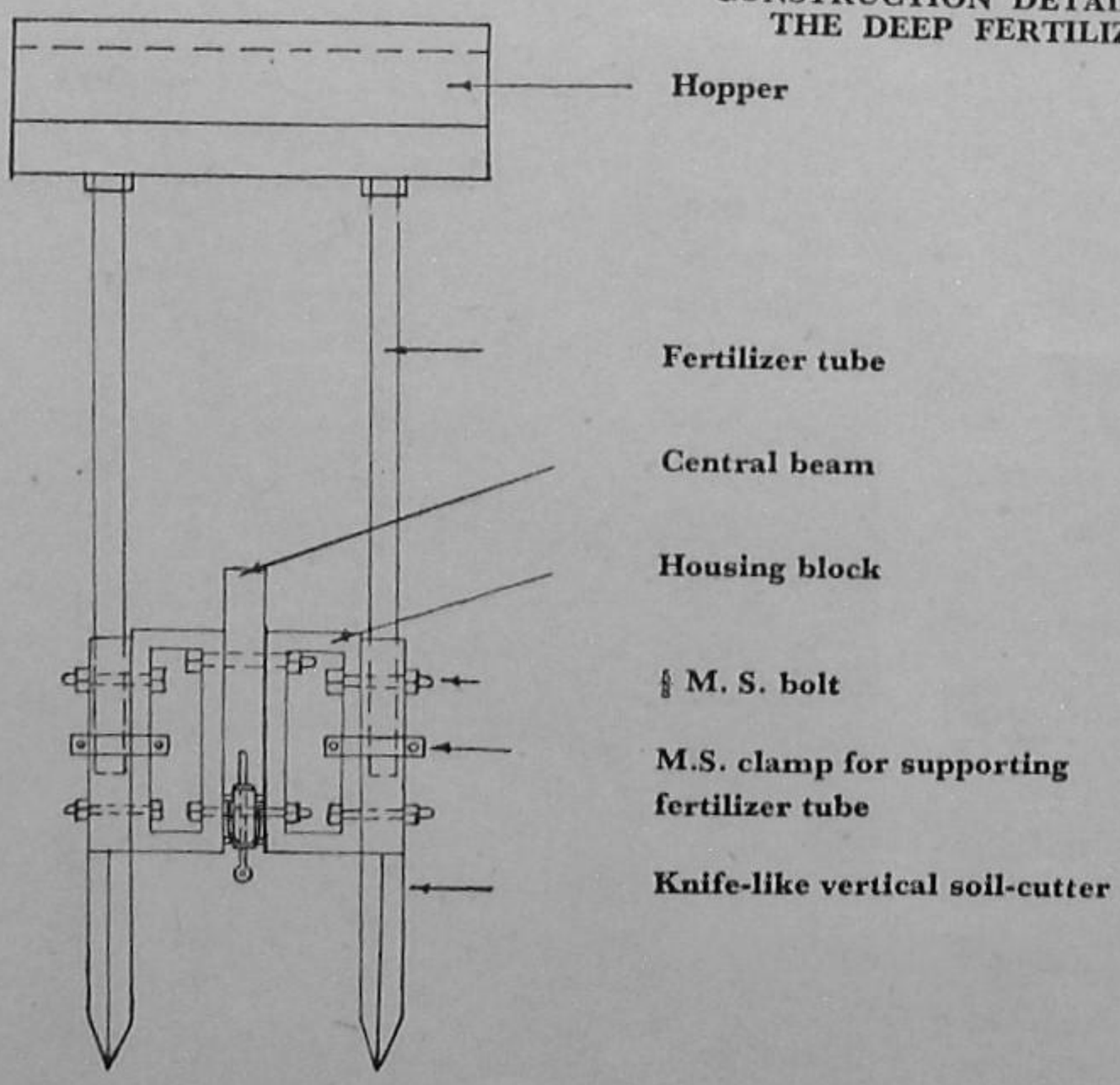
MORE YIELD

In an experiment to compare the deep placement of fertilizer by this implement with fertilizer application in the plough furrow (about two to three inches deep), the following results were obtained.

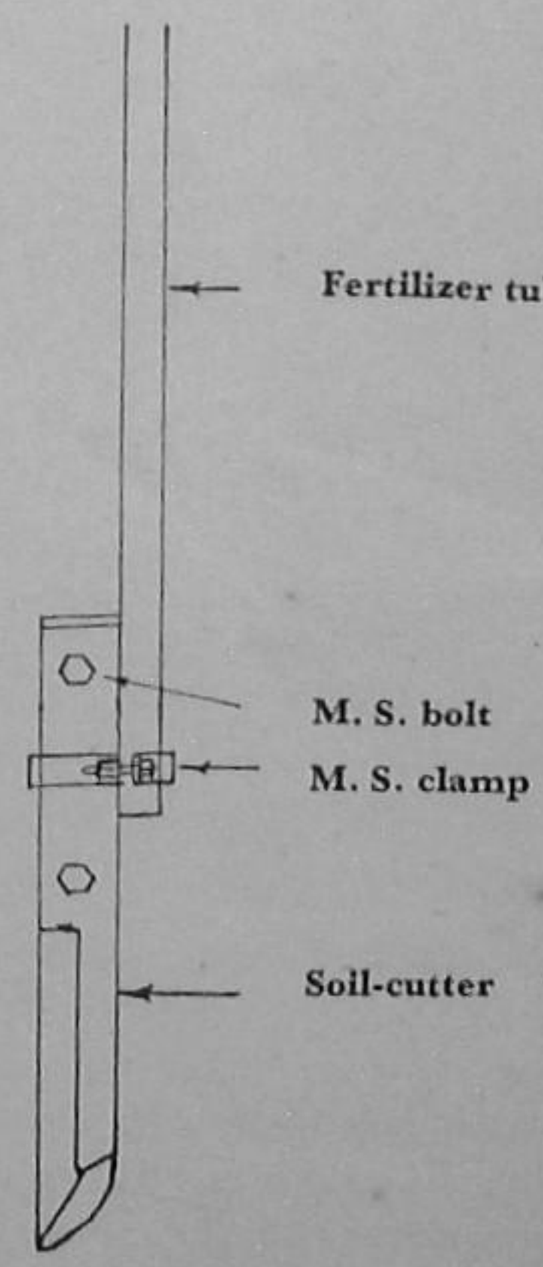
	Yield in pounds per acre		*Estimated cash return per acre*
	Total cured leaf	*Bright leaf**	*Rs.*
In plough furrow two to three inches	825	363	720
By the "Deep Fertilizer" six inches	990	427	957

*Bright grades make the prized leaf in flue-cured tobacco and usually fetch over 60 per cent of the income from the total harvest

CONSTRUCTION DETAILS OF THE DEEP FERTILIZER



Front elevation



End elevation

The Worm That Spins Tasar

by
Chow Kuang-ming
and
Chien Ta-yuan
Sericultural Institute
Academy of Agricultural Sciences of China

An adult tasar silkworm in the fifth molt

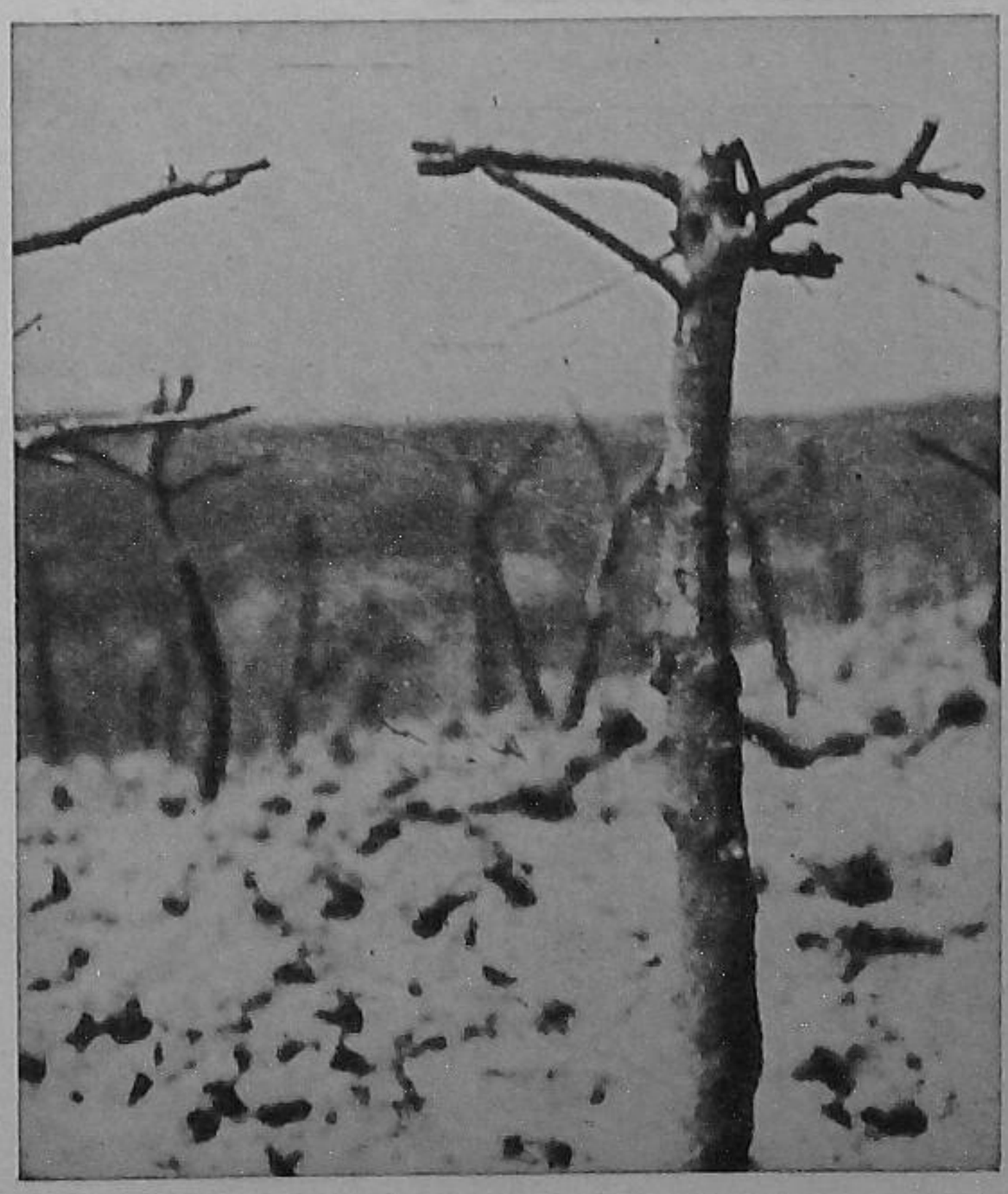
The tasar, tusser, or tassah silkworm, *Antheraea pernvi* G. Meneville, in terms of economic significance, is one of the most important silk-spinning insects. In the classifica-

THE tasar silkworms have been reared in China for centuries. As far back as 1,800 years ago, farmers collected the naturally produced tasar silkworms from the mountainous regions and reared them as a source of silk. It was not until the last several decades that this species was introduced into Korea and Japan. It was naturalized in the Soviet Union from north-east China in 1930.

So far, China still leads in the production of tasar silk, and it no doubt plays a definite role in the economy of the country. Of the total annual world output of the silk, more than 90 per cent is produced in China. The silk-producing areas of China are mainly in the provinces of Liaoning, Shantung, Honan, Kweichow and Szechwan. In the north-east provinces, the yield amounts approximately to 70 per cent of the total of China.

As to quality, the silk produced by the tasar silkworms is by no means inferior to that by the domesticated ones. Besides being used as material for textiles, the silk provides industry with powder bags, parachutes, acid-proof work-clothes and equipment. It is also being used extensively in the manufacture of flexible cords and tires.

A year old tree



tion of entomology, it belongs to the genus Bombyx, family Bombycidae, order Lepidoptera, class Insecta, phylum Arthropoda.

GENERAL HABITS

The silkworm larvae chiefly hatch from the egg-shells between 6 and 10 a.m., especially from 7 to 8 a.m. The newly hatched larva is, as a rule, fond of eating its own egg-shell or chorion, while the exuviated insect swallows its own old epidermis. Experienced rearers point out that chorion and epidermis intake is a striking sign of a healthy individual. This experience may be considered scientific.

It is observed that young silkworm larvae are usually inclined to crowd on the head cluster of a tasar tree, ingesting young and tender leaves as food. On the surface of these leaves, aggregations are generally formed. Throughout the various stages of development the larvae instinctively drink water. Such fondness for water is just not true of the ordinary silkworm. After a prolonged drought one can see them taking in raindrops with their mouths.

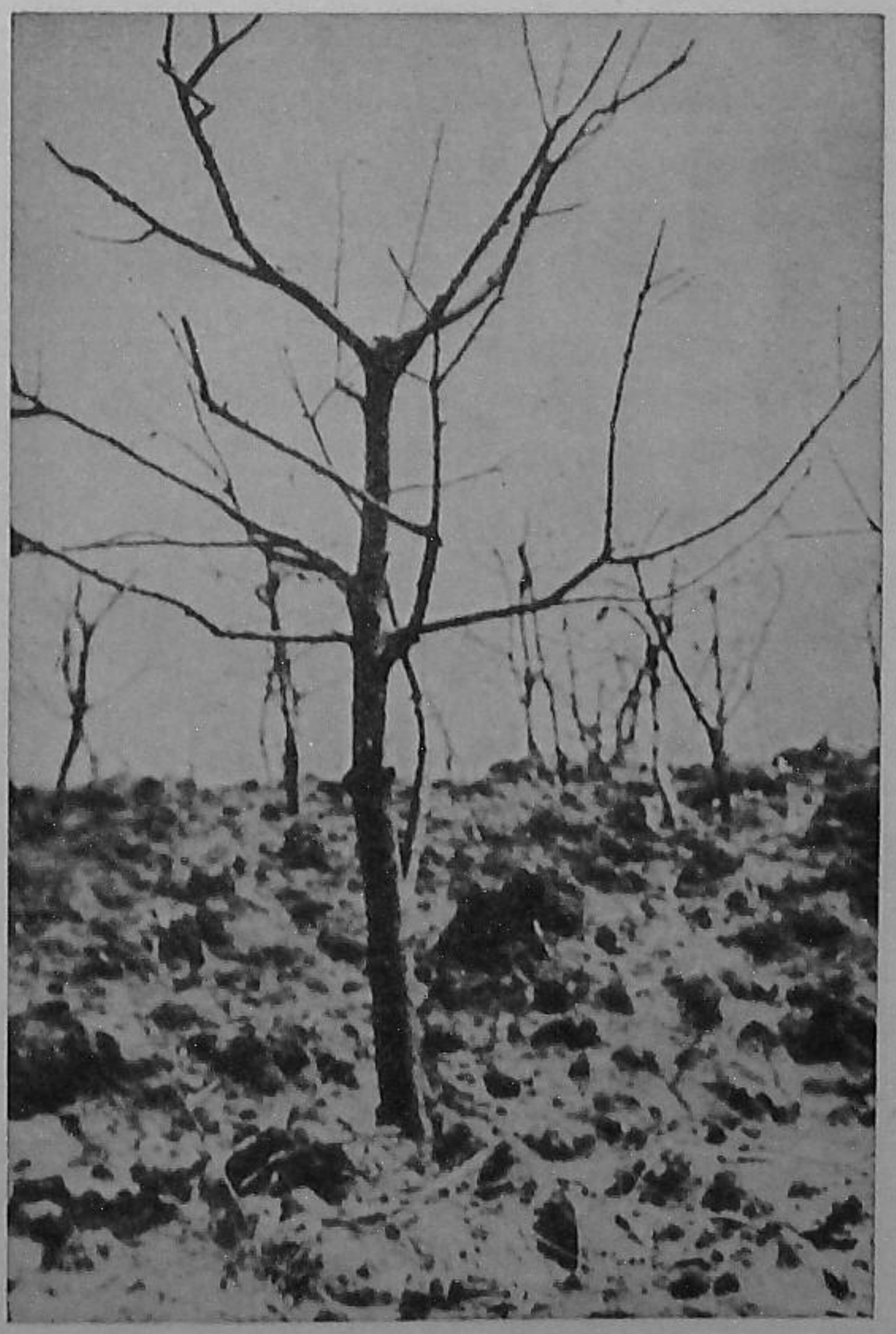
During the young larval stage, the larvae aggregate on twigs where they like to consume tender leaves. Ordinarily, after the second instar they remain to ingest tender leaves, but their gregarious habit becomes gradually weakened.

The grasp of the pedes spurii and pedes abdonimales of the caterpillars is extremely strong. When occasionally attacked by a bird or other enemy, only the upper part of a caterpillar may be eaten away, but its pedes spurii will hold stubbornly on to the twig. Consequently, in collecting these individuals it is quite necessary to lift them up as quickly as possible by the pedes spurii, otherwise they may be injured. The grasping power of their pedes spurii and pedes abdominales helps them weather storms and other adverse natural conditions.

The caterpillars are very sensitive. A sudden vibration of tree or sound may serve as stimulus for their immediate cessation of ingestion and mobility. A full grown caterpillar is also very active in seeking the best place to spin its cocoon. At first, it spins a supporting loop of silk on two or three leaves among which the cocoon is constructed. As soon as the shell of the

Trimming and transferring

A two-three year old tree



rudimentary cocoon is formed, it climbs out through a small hole previously provided by itself at one end of the cocoon, and crawls up along the twig to build a hinged portion of the cocoon, then finds its way back into the cocoon to continue spinning. This is also a distinguishing characteristic of the tasar silkworm.

In general, a tasar silkworm will be fully developed to spin a cocoon after four instars and five molts. The number of instars and ecdyses undergone by a worm is relatively inconstant. When the natural environment is unfavourable—weather too dry, leaves dry quickly, or other physiological disturbances, it may undergo five instars and six molts. Perhaps this is generally true of all wild silk-producing insects.

During the first instar, the caterpillar may sleep on the top or inside of the leaf. After the second instar, it usually rests with its abdomen upwards and back downwards on the inside of the leaf, the bottom or sheltered side of the top twig, or on the vein.

The tasar silkworms feed on leaves of a wide variety of the tasar trees. Writers differ greatly as to the names of these trees, given according to their form, colour and germination. At present, those most commonly used for feeding the worms are of three main varieties, viz., *Quercus acutissima* Carr., *Quercus serrate* Thunb and *Quercus dentata* Thunb, as well as a number of food plants such as *Salix viminalis* Linn. and *Betula japonica* Sieb and Wink.

VARIETIES

The main varieties in China at the present time are those which have been selected over a number of years by silkworm rearers, but few of them have ever been examined and arranged. Only comparatively recently, research organizations in China have begun to cultivate new varieties. The early sericulturists have enumerated the performance of the tasar silkworms as follows.

Greenish silkworms. They are bluish green in colour varying from dark blue to light blue. The former is of coarse cuticle, slow in locomotion, appetite great, resistance to disease weak and spinning at a later stage. The latter is active and vigorous in locomotion, but appetite is delicate, spinning starts at an earlier stage and adaptability is high.

Yellowish silkworms. The members of this variety are yellowish coloured varying from sable yellow, pale yellow to almond yellow. The sable yellow are highly adaptive and eat voraciously. Their stage of development is comparatively long, and the cocoons made are bigger in size. But they are frequently liable to damage caused by early frost. The pale yellow are adaptive too, though they have a delicate appetite, and the stage of development is shorter. The size of their cocoons is small but of a very fine quality. The adaptability of the almond yellow closely resembles that of the preceding two and they are, therefore, preferred by some silk breeders.

Greenish yellow silkworms. These are with greenish yellow cuticle. Their appetite is moderate, but adaptability is strong and the silk of superior quality. They are the most favoured species raised in Liaoning at present.

Silvery white silkworms. The cuticle of these individuals is silvery white, somewhat transparent and brilliant. The hues may be distinguished from pure white to pearly white. The former is called the silvery white and the latter water blue. But in reality the two are of the same variety. Their appetite is moderate, and they spin medium-sized cocoons of the best quality at a later stage. Low resistance to disease is their weakness.

Shantungs. The so-called Shantungs are well-known Chinese silkworms of various shades of colour. Some are dark blue, others light blue. But they live under much the same cultural conditions. In general, they are physically stout, having a good appetite, a longer stage of development, and a higher percentage of cocoons, and are preferred by the local farmers.

METHODS OF CULTIVATION

Egg-warming. This is completely similar to the practice of accelerating the embryonic development of the domesticated silkworms. When the period to commence the warming of eggs comes around, they are brought to the heating chamber for the purpose of acceleration by reasonably increasing temperature and humidity. The time of incubation, however, should correspond with the development of leaves of the tasar tree.

In Liaoning localities, the cultivation of the spring stock generally commences in late April, in Shantung localities, in the middle of April, while in Kiangsu localities such as Chenkiang and Yangchow, in early April. The optimum temperature for acceleration may be varied in different localities. In the North-east, the starting point is 16°C (60.8°F). On the following day, it is raised to 17°C (62.6°F) and on the third day, to 18°C (64.4°F), where it remains as the mean temperature till hatching takes place. In Shantung, however, the prevalent natural temperature is taken as the starting point with an increase of 0.5°C each day up to 18°C, where it is kept as the mean temperature. The preferred temperature for warming eggs adopted by the Sericultural Institute is 60°F on the first day with a

CONTINUED ON PAGE 38

MARSHAL TITO AT "INDIA 1958"

His Excellency Marshal Josip Broz Tito, President of the Federal People's Republic of Yugoslavia, being shown round the Food and Agriculture pavilion at the "India 1958" Exhibition in New Delhi which he visited on January 15, 1959. Extreme right is Shri A. M. Thomas, Union Deputy Minister of Food.

The Village Leader of Veeravalli Block and his *Sesbania* crop

GRASSHOPPERS GET SPRAY FROM AIR

About 15,000 acres infested with the Deccan wingless grasshopper, threatened severe damage to the mixed crop of *jowar*, groundnut and tobacco in south Satara district of Bombay State during October, 1958.

The Directorate of Plant Protection, Quarantine and Storage, in collaboration with the State Government, carried out aerial spraying with insecticide on about 7,033 acres against the pest. Due to the operation, there was a total expected saving of about 9,000 maunds of foodgrains worth about Rs. 1,08,000. On an average, 95 acres were covered in one flying hour and 500 acres in one day, though the maximum area covered in a day was 925 acres. In all, 15,176 gallons of insecticide solution were sprayed in 73½ hours.

News and Pictures

If the good work that some trained Compost Leaders in Madras State are doing catches on, the State would surely achieve its target of producing half a million tons of manure by the end of 1959-60.

Leader S. Ganesan of the Madurantakam Block first set an example by digging improved type of trenches in his own fields and composting green leaf and other organic wastes in the proper way. It was then easy for him to persuade the other farmers of the villages Pathur, Arasarkoil and Chethimedu under his charge, also to do so. In Pathur, even the women and children came forward and 54 pits were completed within a month and a half—sufficient to give 380 tons of valuable compost. He plans to cover all the villages at least ten miles around in this way and produce a minimum of 1,500 tons of compost.

Similarly, Leader Visuwasam of village Mylapore in the Dindigul N.E.S. Block has also shown great initiative. Visuwasam who also happens to be the president of the village *panchayat*, has chalked out a plan according to which each farmer would be required to prepare ten tons of compost per year for every acre

Leader Ganesan explains to villagers the way to dig proper trenches

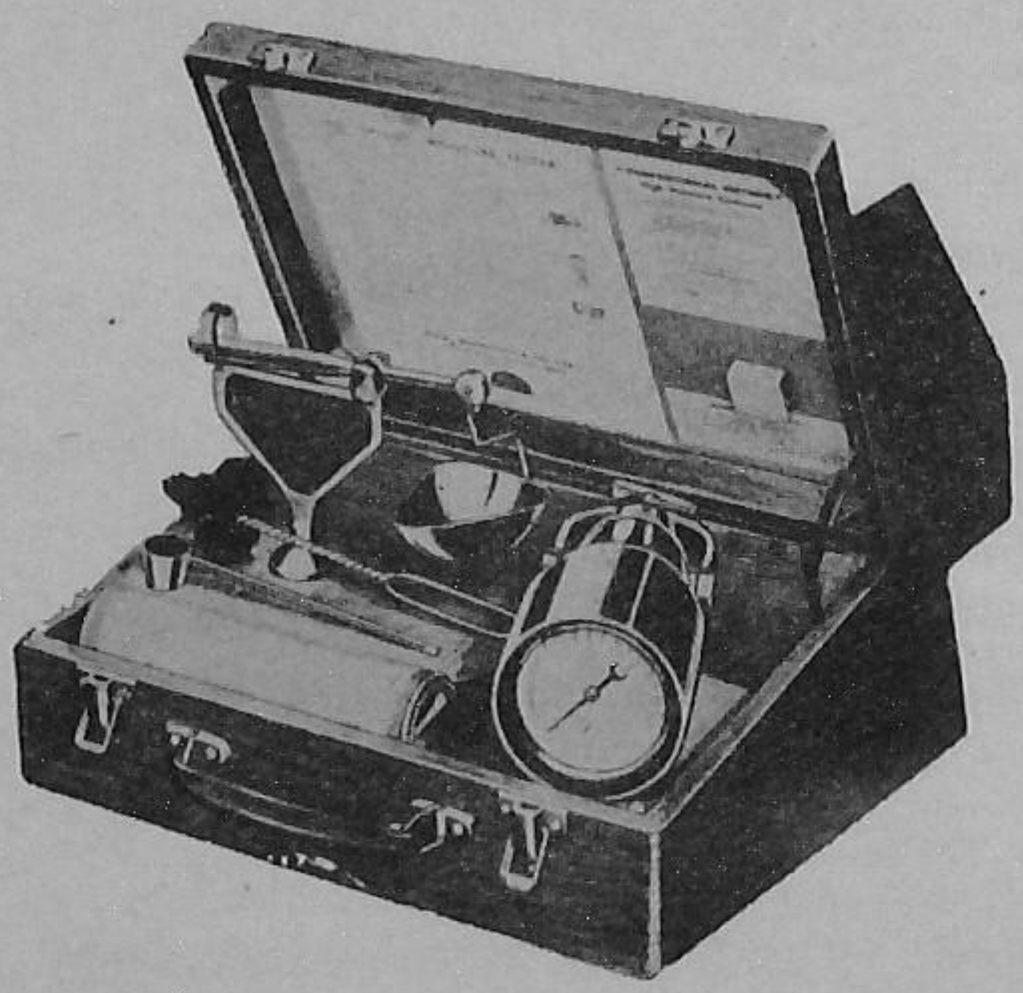
of his land. Thirty-six compost pits of the size 15 ft. x 8 ft. x 3 ft. and six of 30 ft. x 8 ft. x 3 ft. have already been completed. The villagers of Avrampatti, Kunjanampatti and Kamakshipuram have gone even further —they have decided to organize and dig one compost pit for every acre of their land.

Green manuring too is receiving equal attention. A Village Leader in the Veeravalli N.E.S. Block has put an extensive area—500 acres, under *Sesbania speciosa*. Because of this, the average per-acre paddy yield from this block is estimated to go up to 35 maunds.

R. P. Talati

FARMERS GO SIGHTSEEING

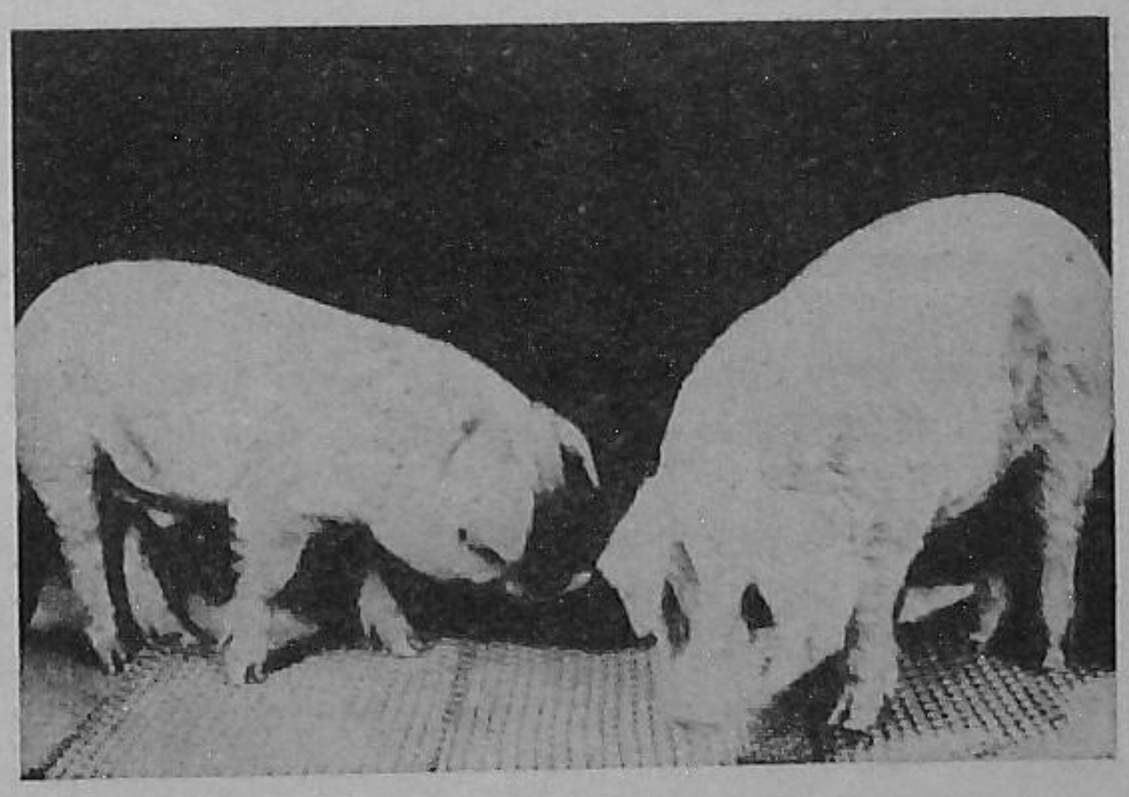
A number of *kisan* parties comprising nearly 700 farmers from Bombay, Gujerat and Madhya Pradesh, recently went on a sightseeing tour of the different parts of the country. They also visited the Forest Research Institute and College, Dehra Dun, where some of them are seen examining the exhibits in the Timber Museum.



MOISTURE TESTER

Whatever the harvesting method, the moisture contained in the structure of the grain as well as on the outside is vital to the farmer. If the grain is too wet, harvesting has to be postponed, as otherwise it would spoil on storage. To provide the farmer with a method of determining the water content of grain, a firm in England has patented an apparatus.

The principle of the apparatus is the instant release of gas from the Absorbent provided on contact with the moisture in the sample. The pressure of the gas released registers on the dial gauge indicating the percentage of moisture. A Grinder is provided to obtain a ground sample, which is essential if the true moisture is to be obtained. This allows the reading to include the moisture which is within the grain structure. The ground sample is weighed on a counterpoised balance (no weights needed) which is included in the complete outfit. This comprises the actual testing implement: a counterpoised balance, scoop for measuring Absorbent, a tin of Absorbent sufficient for 50 tests, a cleaning brush, a spare rubber washer and complete working instructions.



BOON TO LIVESTOCK RAISERS

The difference in size of the two young hogs shown here is an evidence of the boon to livestock raisers which arose from the discovery of the wide-range antibiotic Aureomycin chlortetracycline ten years ago. Both are from the same litter. Both received the same ration with one difference—the hog on right had a tiny amount of Aureomycin added to its feed. Such growth gains mean more meat production in less time at less cost to the farmer.

Experience in almost every country in the world has proved the value of a feed supplement containing both vitamin B12 and Aureomycin for livestock, including beef and dairy cattle, laying hens, poultry, swine, turkeys, sheep and calves. Animals fed on such an antibiotic supplement are more free from disease, put on weight more quickly, and consume less feed per pound of weight gained than do animals given a ration without it.

what we need is a good fodder programme

by

T. S. Gill
Agriculture Division
Planning Commission
New Delhi

IT has been estimated that with proper feeding, an ordinary village cow in India would yield 50 per cent more milk on an average ; in the case of the generally well-cared for buffalo, the increase may only be about 15 per cent ; the efficiency of the draught-cattle of the country as a whole would go up by 60 per cent. But the available supplies of concentrates and roughages can feed only about 30 and 70 per cent, respectively, of the existing cattle population. That is why it was recommended in the Second Five Year Plan that "gradually attention must be given to the fodder programme as this is an essential basis for the programme of cattle development."

The cattle population of India, including buffaloes, is about 200 million—a fourth of the total cattle population of the world. The importance of cattle to India's economy can be judged from the fact that they contribute no less than Rs. 664 crores per year, which is about 16 per cent of the national income from agriculture, to the gross national income. This includes the value of the animal power used for draught purposes, for agricultural operations and for the transport of commodities.

However, the quality of our cattle, whether draught or milch, is very poor. Ten per cent of our cattle population comprises inefficient, old, nondescript and useless cattle. The Cattle Preservation and Development Committee in 1947 estimated the unproductive adult cattle at 11.5 million. They are a serious drain on the already scanty feed and fodder resources of the country. Again, some of our best breeds are met with in those parts of the country which receive very small amounts of rainfall, generally have no means of irrigation and are subject to periodical famine. The portion of the cattle population which is worth preserving is, therefore, affected.

The feed and fodder resources of the country can be improved by

(*i*) introduction of exotic types of nutritious fodders ;

(*ii*) evolution of high-yielding strains of various fodder crops ;

(*iii*) adoption of improved techniques of production ;

(*iv*) development of grassland farming ;

(*v*) improvement of natural grazing grounds in forests and the village grazing lands (*shamlat* lands) ;

(*vi*) preservation of surplus fodder ; and

(*vii*) development and use of subsidiary feeds, e.g., mango seed kernel, *jaman* seed, tamarind seed, fishmeal, slaughter-house wastes, etc.

Green fodder not only improves the condition of livestock, but also brings down the maintenance cost of animals by reducing the quantity of concentrates required. Unfortunately, very little research has so far been done in the country on the introduction of new fodders from other countries, such as several types of peas, lespedezas, alfalfa, clovers, teosinte (*makchari*), beans, grasses, etc. In the Punjab, however, a good deal of work has been done on fodders, and a plan for raising fodder crops and grasses which would supply green fodder throughout the year, has been evolved. The Punjab farmer now has different high-yielding new varieties suited to varying conditions of soil and climate to choose from as shown in the table on the next page.

Harvesting season	*Fodder*	*Crop*	*Sowing season*	*Yield per acre (in maunds)*
January	Japanese mustard, berseem (Egyptian clover), lucerne (alfalfa)	Japanese mustard	End of September to October	300 to 600
February	Early oats, berseem, lucerne	Berseem	End of September	600 to 800 (five to six cuttings)
March	Oats, berseem, *metha* (fenugreek), *senji*, lucerne	Oats	October-November	300 to 400
April	Late oats, berseem, lucerne	Lucerne	October-November	800 to 1,000 (eight to ten cuttings)
		Metha	October-November	300 to 350
May	Berseem, Sudan grass, lucerne and grasses	*Senji*	October	300 to 400
June	Sudan grass, maize, cowpeas, lucerne and grasses	Turnip,	September-October	400
		Sudan grass	March-April	500 to 600 (three cuttings)
July	Sudan grass, *jowar* (sorghum), cowpeas, lucerne and grasses	*Jowar*	April to July	300 to 400
August	Sudan grass, *jowar*, cowpeas, lucerne and grasses	*Makchari*	July	400
September	Sudan grass, *jowar*, *moth* (*Phaseolus* sp.) cowpeas, lucerne and grasses	*Moth*	April to July	200 to 300
October	*Jowar*, *makchari* (teosinte), *guar* (pigeon peas) and lucerne	*Guar*	July	300
		Cowpeas	April to July	200 to 300
November	*Makchari*, berseem, mustard, lucerne	Elephant grass	February	600 to 800 (four to five cuttings)
December	Berseem, lucerne, mustard, turnip	Guinea grass	February	300 to 400 (four to five cuttings)

It is time that work on similar lines was taken up by the other states also. Leguminous fodders such as lucerne, berseem, cowpeas, field peas, etc., not only improve the health of animals, but if included in crop rotation also improve soil fertility. The Kudzu vine would not only help in checking soil erosion on steep slopes, but also supply green fodder both for grazing and stall feeding.

IMPROVED TECHNIQUES

Due to the extreme pressure of population, both human and cattle, there is a heavy demand on the cultivated land for growing foodgrain and fodder crops, and for grazing. There is very little scope for raising extensive pastures for grazing cattle. In the absence of good grazing and lack of concentrates, stall-feeding the animals with green fodder is the only alternative.

The yield of green fodders, therefore, needs to be increased by intensive cultivation and improved techniques. The growing of fodder crops has to be popularized. This policy is being pursued in the Key Villages where adequate arrangements are made for the production and distribution of fodder seeds, roots and cuttings of the desired varieties. In order to make the growing of new fodder crops popular, cultivators are being provided with the planting material at a 50 per cent subsidy. In addition, it is highly desirable that the usefulness and advantages of growing nutritious fodders for the cattle are driven home to farmers through appropriate information measures.

GRASSLAND FARMING

As commonly understood, grassland agriculture is not limited to grasses but also embraces their common associates of the legume family, such as clovers, lespedezas, peas and beans. In grassland agriculture, which is another name for mixed cropping, grasses and legumes are raised together according to the system of management best suited to land use with ample provisions for other crops as needed. Under Indian conditions, grassland agriculture is better than any other type of farming, as it provides more organic

matter to the soil. The legumes harbour beneficial organisms of all kinds. Their innumerable roots penetrate the soil and improve its physical condition. On sloping lands, the sod would control erosion and would simplify the maintenance of contour terraces and watercourses. This type of mixed cropping should be introduced into areas where cattle-raising forms an important part of the agricultural economy.

NATURAL GRAZING

Our main grazing lands are either in the forests or near the forests. These resources are estimated at 85,000 square miles, but are accessible only to a small percentage of animals. They can, however, be developed and reserves of fodder built up, both for grazing and as security against famine. The fodder species in these regions are inferior. Large areas of range lands in these regions are so badly misused that they are in an advanced stage of deterioration. Where the forests are managed by the State Departments of Forests, there is some regulation and supervision, though not always satisfactory. In some state-owned forests even there are open pastures where no stocking limits are prescribed owing to the large demand for fodder. In Bombay State, the forests are classified as

(*a*) those completely closed to grazing, where the most valuable timber is raised ;

(*b*) those where only cutting of the grass is authorized ;

(*c*) those open all the year round.

In view of the grazing needs, state forests should only be placed in the first two classes, and rotational grazing should be practised. According to experts, four years of rotational or restricted grazing would improve both the quality and quantity of the forage production per unit of area. If stocking cannot be restricted everywhere, at least wherever possible, the stocking rate should be fixed according to the land capacity. Complete closure to grazing is sometimes indispensable for the restoration of deteriorated natural grazing grounds.

Tests carried out in the Punjab show that closure for a few years improves the position of the cover, but a protracted closure gives the most valuable forage species. We should, therefore, prefer rotational or deferred grazing considering that properly managed grazing will enable the admission of larger herds than uncontrolled grazing.

In the Second Five Year Plan, a sum of about Rs. 55 lakhs was provided for improving pastures in the forest areas. Satisfactory progress has been made in the States of Bombay, Madras and Himachal Pradesh, and a sum of about Rs. 20 lakhs has so far been spent on improving grazing lands.

There are considerable grazing lands in the areas under *ryotwari* settlements, usually known as village commons (*shamlats*). These lands are now being progressively broken up for cultivation by the owners. It is desirable that, wherever possible, the management of these lands is passed on to suitable local agencies which should introduce rotational grazing by erecting suitable enclosures. Every livestock-breeding farm or a state-owned agricultural farm should have improved pasture land which should be managed on the most up-to-date lines so as to serve as a demonstration centre for the people and a training ground for the staff in large-scale pasture development.

PRESERVATION OF FODDER

Surplus grass from some remote grazing grounds in the forest areas could be turned into hay, and either be kept as reserve to meet an emergency, such as famine, or supplied to other areas. A pilot scheme has been sanctioned with a view to studying the possibility of building such "fodder banks." The scheme has been taken up at the Cattle Breeding and Stud Farm, Hingoli, District Prabhani in Bombay State.

In addition to making hay of various grasses and some of the leguminous and indigenous fodder crops, such as stalks of *jowar* and *bajra*, the surplus green fodder can also be turned into silage. This has been done at the various Government Agricultural Farms, Livestock and Dairy Farms and on the various military farms in the country. The advantage of silage is that the fodder can be preserved in green form without deterioration for use when such fodder is not easily available. It also adds variety to the ration and provides succulent feed for economical milk and draught production. There is an advantage of using green weeds for the purpose. The silage has got to be stored in towers or upright metal silos or in silo-pits dug in the ground. Trench or modified trench-type silos are less expensive to construct, but equally efficient. A subsidy of 25 per cent by the Centre and 25 per cent by the State Government has been agreed to for encouraging the conservation of surplus green fodder in this way.

SUBSIDIARY FEEDS

Since the nutritive potentialities of the natural grasslands are limited, concentrates play an important role in the feeding of livestock in India. There is also a great discrepancy between the supply and demand of the cultivated high-protein fodders, as shown in the table on the next page.

Feeding stuffs	*Estimated requirements*	*Present supply*	*Deficit in supply*
		(in million tons)	
Straw or *kadbi*	190	130	60
Green fodder	289	111	178
Grazing (as green grass)	527	453	74
Oilcakes	11.53	2.88	8.65
Maize	8.87	7.70	1.17
Barley	8.41	2.34	6.07
Gram	8.24	3.59	4.65
Cotton seed	3.73	1.28	2.45
Bran	4.83	1.97	2.86

In addition, about 1·24 million tons of husk-*chari* from gram and pulses are available, having a nutritive value of approximately that of bran. Continuous efforts throughout the country need to be made to bridge this gap by taking up suitable schemes for enhancing the production of fodder resources and controlling the increase in the cattle population, especially the uneconomic portion of it.

A good deal of work on the development and use of subsidiary feeds, such as mango seed kernel, *jaman* seed, tamarind seed, fishmeal and slaughter-house wastes, has been done at the Indian Veterinary Research Institute, Izatnagar. Those feeds are reported to be valuable concentrates. It has been estimated that it could be possible to obtain about 11 million tons of concentrate feeds on an All-India basis. The main difficulty is that these feeds are very much scattered not only throughout the length and breadth of the country, but even in the villages themselves. It is very difficult to arrange for the collection of these products in substantial quantities. In a village, the quantity in terms of the feed value may be as much as can be obtained by the cultivation of one or two acres of high-protein fodder crops. However, efforts should be made to educate the cattle-owners about the utility of these subsidiary feeds.

All this would require a close co-ordination and co-operation of the various development agencies, namely, the National Extension Service and the Community Development Blocks, the departments of Animal Husbandry, Agriculture, Forests, Co-operation, etc. High priority needs to be given to the areas of well-defined breeds of cattle. Development of the feed and fodder resources should receive the same emphasis as the breeding of superior strains of cattle in the Key Village Scheme.

PINES IN PEAT "PADS"

Academician Pogrebnyak of the U.S.S.R. has elaborated a new method of growing pines in the sands. Up till now sands were ploughed to plant trees. This led to their blowing away and the destruction of the plantations. In order to save the saplings from the wind the scientist proposed planting them under a cover of wild grasses, clearing for the young tree only a small square of soil. But the chief innovation was the utilization of peat "pads" for planting pine saplings. Peat placed in special holes in autumn possesses as is known, considerable moisture capacity, imbibes a good deal of water in winter and, when year-old pine saplings are planted into it in spring, serves as an excellent source of food and moisture for them. By the way, peat is found in abundance not far from the arenas.

The new peat-hill method of planting pines gained general recognition very rapidly. Even in the extremely dry year of 1951 when 82 per cent of trees in the ordinary plantations perished in the Lower Dnieper sands, eight out of every hundred trees took root and survived on Academician Pogrebnyak's plots. In 1952, "Pogrebnyak's plantations" already covered thousands of hectares. During the four years that followed, sylviculturists raised by 50 per cent more forest in the sands than in the preceding 120 years. The strong, healthy trees that have taken deep root in the sands are no longer afraid of the sand storms or draughts. No, the climate has not grown milder here. Last summer practically no rain fell on the sands. And yet some of the teams in the forest farms managed to preserve up to 97 per cent of the saplings.

A scientist who remakes nature has many friends. Vasili Kicha, a self-taught locksmith of one of the forest farms, designed the first machine in the world of placing peat in the sands. His tractor-drawn peat-filler not only portions out the peat and places it in the earth at a definite depth, but automatically leaves a "landmark" by throwing a piece of peat on the surface of the sand. This machine replaces one hundred workers. Two-three aggregates of this kind are enough to fertilize ten thousand hectares of arenas every year, in other words, the entire area stipulated in the State plan.

Another suggestion has been also successfully tested for several years now on the Lower Dnieper sands. The Leningrad agrophysicists I. Revut and D. Dotsenko proposed covering the sands with a layer of a bituminous emulsion which can hold back the movement of the quicksands for a period of two to three years. The sylviculturists have found a great merit in this emulsion. If the area around the saplings is covered with it, the emulsion easily lets through the rain water, but decisively impedes the growth of weeds. This property considerably cheapens and simplies the care of the forest plantations.

—News and Views from the Soviet Union

Research Note

HOW CROPS RESPOND TO FERTILIZERS IN BIHAR SOILS

by
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and
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RECOGNIZING that fertilizer experiments conducted on farmers' fields rather than on experimental farms provide more reliable results for making recommendations to farmers, trials were taken up in Shahabad district of Bihar State under a scheme with financial assistance from the Indian Council of Agricultural Research. The work which involved a soil survey and simple manurial experiments on cultivators' fields, lasted for three years—from 1952-53 to 1955-56. Here is a brief report of the results achieved.

The number of successful experiments was 290, of which 142 were on paddy and 148 on wheat. The design of the experiments was the simple three-plot one: control, 40 pounds nitrogen as sulphate of ammonia and 40 pounds nitrogen as sulphate of ammonia +40 pounds phosphoric acid. These five *thanas* of the district were selected for the experiments: Arrah, Dumraon, Bikramganj, Sasaram, Bhabhua. The selection of villages and plots was done by the random method.

GENERAL FEATURES

The district is surrounded on three sides by two rivers—the Ganges in the north and the Sone in the east and south. Excluding the undulating hilly tracts which constitute a table-land mostly covered by the Kaimur hills (which are of the Vindhyan formation lying towards south-west), the district is more or less a plain. Of the total area of about 4,400 square miles, alluvial soils cover about 3,600 square miles and hilly tracts the remaining 800.

The climate is tropical, with an annual rainfall of 44.96 inches most of it being confined to three months from the middle of June to the middle of September; the remaining period is more or less dry. The temperature varies from 88.5° F to 67.4°F. Paddy is the most important crop of the district and covers nearly 65 per cent of the total cultivated area, gram coming next with 20 per cent and then wheat with 14 per cent.

SOIL SURVEY

A reconnaissance soil survey of the area was undertaken. Nearly a 1,000 soil samples were collected from soil profiles at every six miles (at smaller distances if the soil changed), observations collected, and a detailed soil map drawn. Besides these, soil samples from the sites of manurial experiments were also analysed.

On the basis of morphology, topography and the main river system influencing the formation of soils in the district, the soils have been classified into different soil series and types, a brief description of which is given below.

Sinha Series. These soils are of the recent alluvium type formed by the flooding influence of the river Ganges, and even now they are flooded every year. Profiles have clear and defined layers varying from six to 19. The texture is sandy to silty loam with occasional clayey layers. Concretions are absent and soluble salts are high.

Arrah Series. The soils under this series are also derived from the Gangetic alluvium, but are of comparatively older origin. Here, four to 12 profile layers are observed, the texture being loam to clay-loam on the surface and tending to be heavier downwards till an abrupt change to sandy layer at the bottom. Calcium carbonate concretions are observed in the clayey layers and the soluble salt contents are low.

Akhgaon Series. This series is formed by the influence of the river Sone due to flooding. Here, four to 11 clearly defined layers with a sandy to loam texture are observed with typical Sone sand deposits at the bottom. No concretions are observed and soluble salts are moderate to low.

Behea Series. This series also is formed by the river action of the Ganges, as the Arrah Series, having a lighter texture as of the Sinha Series, but differs from the Arrah Series in having a porous subsoil. Profile layers, only three to four in number having a low soluble salt content and higher amount of

calcium carbonate distributed all along the profile, are observed.

Piro Series. This series also is a Gangetic alluvium situated far from the river and includes a large area of Shahabad district. The soils under this series have a loam to clay-loam texture on the surface with heavy layers below. The number of layers varies from three to seven. Iron and calcium carbonate concretions are observed throughout the profile and the soluble salt content is low.

Karghar Series. This series, though alluvial in nature as the Piro Series, is formed due to depression in the relief, and topography has played a very important part in its profile development. It is different from the Piro Series in having a heavier texture and more soluble salts, the other features remaining more or less the same.

Dehri Series. The soils under this series are formed by alluvial deposits from the river Sone as well as by hill washings from the Rohtas hills, and as such the texture of the soil is very variable. Varying amounts of gravels and iron concretions are present, the latter being more prominent at lower depths. The soluble salt content is low.

Pajraon Series. The soils under this series are formed by the action of the river Karamnasa and have a sandy texture on the surface followed by loam or clay-loam soils below. Different layers of the profile are clearly defined and range from three to five in number. Some concretions of calcium carbonate are found in the lower depths. The soluble salt content is low throughout the profile.

Kishunpur Series. This series is formed under the influence of the river Durgawati and the soils are of a medium to heavy texture throughout the profile. They contain high amounts of soluble salts, iron and calcium carbonate.

Chainpur Series. This series is formed by the river action of several small rivulets like Gahawar and Shama. It differs from the Kishunpur Series in having a lighter texture on the surface and comparatively much lower soluble salt content, the other features remaining more or less the same.

MANURIAL RESPONSES

The results of experiments falling under the different series showing the average figures of response to the manurial treatments given are indicated below.

Name of series	*Paddy*		*Wheat*		*Remarks*
	40 pounds nitrogen	*40 pounds phosphoric acid*	*40 pounds nitrogen*	*40 pounds phosphoric acid*	
Sinha	—	—	—	—	No experiments fell in this series
Arrah	56.775(8)	20.63(8)	444.67(15)	142.6(15)	
Akhagaon	—	—	—	—	do.
Behea	—	—	—	—	do.
Piro	397.10(49)	230.2(49)	460.23(43)	141.40(43)	—
Karghar	588.29(38)	465.5(38)	453.25(40)	309.5(40)	
Dehri	631.0(10)	701.00(10)	520.0(4)	300.0(4)	
Pajraon	—	—	—	—	do.
Kishunpur	528.09(10)	480.0(10)	640.0(2)	560.0(2)	
Chainpur	455.0(10)	141.67(6)	240.0(10)	172.0(10)	

The figures in the brackets indicate the number of experiments

Response to nitrogen. The highest response on paddy was observed in the Dehri Series(631·0 pounds per acre) followed by the Karghar, Arrah and Kishunpur Series which gave responses of 588·2 pounds, 567·5 pounds and 528·0 pounds per acre, respectively. The Chainpur and Piro Series which followed next gave responses almost on the same level, being 455·0 pounds and 397·10 pounds per acre, respectively.

In the case of wheat, the Kishunpur Series gave the maximum response of 640·0 pounds per acre, but the conclusion may be flexible as it is based on the results of two experiments only. Next comes the Dehri Series with 520·0 pounds per acre, but here also the conclusion may not be correct as it is based on the data of four experiments only. This is followed by the Piro,Karghar and Arrah Series which have a low level of response (460·2 pounds, 543·3 pounds and 444·7 pounds per acre, respectively). The least response (240·0 pounds per acre) is found in the Chainpur Series.

Response to phosphoric acid. In the case of paddy, the maximum response has been obtained in the Dehri Series (701·0 pounds per acre) followed by the Kishunpur and Karghar Series giving almost similar responses of 480·0 pounds and 467·5 pounds per acre, respectively. Next in order comes the Piro Series giving an average response of 230·2 pounds per acre and the Chainpur Series giving a response of 141·7 pounds per acre. The

Arrah Series, however, has given a negative response of 20·6 pounds per acre.

In the case of wheat, the highest response is obtained in the Kishunpur Series (560·0 pounds per acre), but here also the data are very meagre to arrive at a definite conclusion. The Karghar and Dehri Series are at par with each other, giving a response of 309·5 pounds and 300·0 pounds per acre, respectively, whereas the Chainpur and Arrah Series which follow next gave a response of 172·0 pounds and 142·7 pounds per acre, respectively. The lowest response is observed in the Piro Series, being only 141·4 pounds per acre.

SOIL DESCRIPTION

Arrah. The soils of Arrah on which the manurial experiments were conducted varied from clay to sandy-loam on the surface, tending to be mostly lighter in the subsoil followed by heavier soils below in many cases. The surface soil was somewhat granular in structure, the compactness of the different layers depending on their texture. Profiles up to a depth of six feet indicated generally three to four layers. Concretions consisting mostly of calcium carbonate were observed generally in layers below two feet. At some places, blackish and brownish concretions of iron pyrites, sparsely populated, were also observed.

Dumraon. The soils of this area in the case of paddy experiments were found to vary between loam to clay in texture. In the case of wheat grown on uplands, sometimes a sandy to sandy-loam texture was also observed. In all the cases, the subsoils tended to be heavier downwards than the surface soils. Nearly three to four layers were observed up to a depth of six feet. The surface soil was generally granular in structure, the compactness depending on the texture of the soil. Concretions of calcium carbonate mixed with iron pyrites were generally observed in clayey layers.

Bikramganj. The surface soils of this area were generally sandy-loam to clay-loam in texture with porous and lighter subsoils. In some cases, heavier subsoils were also observed. The surface soil was granular in structure, but the subsoils were mostly structureless except in clayey layers where a nutty structure was observed. Throughout the profile, the presence of calcium carbonate and iron pyrite concretions was noticed which increased appreciably with the depth.

Sasaram. The surface soils of the experimental plots were generally loam to clay-loam, though in some cases sandy-loam textures were also observed which tended to be heavier downwards. Three to six layers were generally observed and the structure was mostly granular throughout the profile. Iron and lime concretions were observed at lower depths in sufficient quantities, but in well-drained soils they were absent up to a depth of six feet.

Bhabhua. The texture of these soils was clayey throughout the profile. Generally, three to four layers were observed and iron and lime concretions were found at lower depths.

From the chemical analysis, it has been seen that the soils of Shahabad district have a fair nitrogen and carbon content (0.059 to 0.069 per cent and 0.472 to 0.534 per cent, respectively, with more or less a balanced carbon/nitrogen ratio (8 75 to 12.78). The available phosphoric acid content of these soils is moderate to fair (0.039 to 0.0073 per cent), but the available potash content is generally low (not exceeding 0.04 per cent). The soils are generally saturated with calcium and magnesium, but the exchangeable potassium and sodium are negligibly small. This seems to have a marked influence on *p*H, as it rarely exceeded 7.5.

Three years' average responses in pounds per acre (treatment-wise and centre-wise) along with C.D. in respect of paddy and wheat are given in the table below.

The average responses to nitrogen in paddy and wheat are significant. The responses to phosphate are also significant in all the centres except Dumraon. The responses to nitrogen and phosphate are the highest in Sasaram in both paddy and wheat.

	Paddy	*Central*	*40 pounds nitrogen*	*40 pounds nitrogen and 40 pounds phosphoric acid*	*40 pounds phosphoric acid*	*C.D. at per cent*
Paddy						
Arrah		1,796(24)	405	650	245	147.97
Dumraon		1,938(24)	412	508	96	216.59
Bikramganj		2,016(28)	514	1,004	490	303.01
Sasaram		1,669(28)	640	1,278	638	101.57
Bhabhua		1,017(28)	535	755	220	118.15
Wheat						
Arrah		564(27)	342	484	142	90.51
Dumraon		692(27)	512	558	46	70.75
Bikramganj		445(28)	381	655	274	70.68
Sasaram		799(28)	435	796	361	40.60
Bhabhua		443(28)	308	619	311	78.46

MY FIVE YEARS WITH BETTER METHODS

by

N. Palanivelu

TO make India self-sufficient in the Second Five Year Plan, it would be necessary to increase the existing food production by 40 per cent. In the Tanjore district of Madras State, where the main crop is paddy, the average production has been estimated at 1,200 pounds of rice per acre. A 40 per cent increase, therefore, would mean only an additional 480 pounds per acre.

I own a plot of 11 acres of wet land. The annual production of this land till 1952 was 24,000 pounds of paddy, and this was obtained by adopting the ordinary cultivation practices together with the use of chemical fertilizers (superphosphate). Even in 1952, the production was 3,000 pounds more than in the previous year.

From 1953, however, I began to follow the improved methods of cultivation recommended by the Madras Agriculture Department. Two acres were brought under a double crop of paddy and I used improved strains, discarding the varieties I was using before. I sowed less of paddy in separate nursery plots; as a result, I saved 45 pounds of paddy seed per acre. After taking into account all the expenditure on the extra manures, there was a net increase of 3,600 pounds of paddy. Encouraged by this, I decided to secure a production of 36,000 pounds in the following year. Accordingly, green manure was cultivated in all the land.

In 1954, I brought six acres under a double crop of paddy and, in that year, I secured a production increase of 8,400 pounds. During the same year, I planted *P. 216 F* cotton and along with it grew vegetables in a plot of 50 cents during the fallow period in the summer. This gave me an additional income of Rs. 250. On the rest of the land, I grew the green manure crop of *Sesbania speciosa*.

In 1955, I put one more acre under the two-crop system and devoted more attention to the cultivation methods. I applied 6,000 pounds of *Sesbania* per acre as green manure, and intercultured all the land thrice. Steps were also taken against insect pests. During that year, there was an additional increase of 9,000 pounds.

In 1956, all the land was brought under the two-crop system. In the first crop, there was a yield of 26,400 pounds of paddy, at 2,400 pounds per acre, and in the second crop, 24,600 pounds, or an average of 2,220 pounds, per acre. Thus, there was a total yield of 51,000 pounds in that year.

During the last year, i.e., in the fifth year of my experiment, all the 11 acres were put under the two-crop system. As against 112 pounds of superphosphate that was being applied to the land during the last four years, I applied 150 pounds of it. In addition, 5,000 pounds of *Sesbania* per acre were used. Also, some of the urine-soaked soil from the cattle-shed was sprinkled on the land. The yield of the first crop was 32,300 pounds, i.e., an average of 2,940 pounds per acre.

However, heavy rains greatly affected the second crop. With steps against insects, there was a production of 22,440 pounds, or an average of 2,040 pounds per acre. The total yield of 42,780 pounds was 3,780 pounds higher than the previous year's production.

I feel proud of my land's increased production and of my own small contribution to the country's food resources. I trust that other cultivators would similarly adopt the latest methods of agriculture and benefit themselves and the country at large.

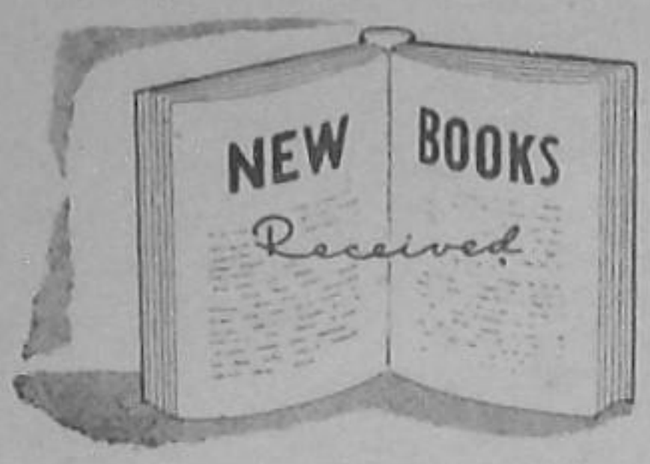
ALL-INDIA CATTLE AND POULTRY SHOW

An All-India Cattle and Poultry Show will be held at Bangalore from February 22 to March 1, 1959.

An All-India Cattle and Poultry Breeders' Conference will also be held on that occasion.

Sponsored by the All-India Cattle Show Committee, the Show will display improved breeds of cattle, buffaloes, horses, sheep, goats and poultry. An agricultural exhibition in which some of the foreign countries are participating will form part of the Show.

A feature of the Show will be the organization of competitions for milk yield, draught capacity, Krah and ploughing capacity, besides horse and bullock-cart races.



Food Administration in Punjab and U.P. 1946-53

by P.K. Mukherjee and Kissen Kanungo

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Social Science Bibliography India, Pakistan 1957, No. 6

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Dry the picked cotton in the open, clean the *kapas* to separate all insect-damaged locks.

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Still more important: if you grow both *desi* and American cottons, have them picked, ginned and pressed separately. If you mix a good cotton with an inferior one, you will get the price of the inferior one for both.

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IMPROVING POULTRY

Maybe the process is a little slow, but crossing the males of the improved poultry breeds with *desi* females is a good method of improving poultry, especially in our villages.

For this, males of the White Leghorn or the Rhode Island Red breed could be used. Compared with the *desi* birds, these breeds give more and bigger eggs.

By using these breeds for crossing with your *desi* hens, you " grade up " your flock.

The cross-bred chickens have better livability ; they do not lose the setting and brooding habits of the *desi* mother. So also they get the instinct of protecting themselves from their natural enemies.

The cross-bred chickens will have a better body-size and egg-size and higher egg-production.

All central and State Government poultry farms stock the birds of the improved breeds for supply to poultrymen.

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During the summer months, palms exposed to the hot sun develop dark patches, especially on the south-western side. The stems get cracked, and wood-rotting fungi enter. On a windy day, especially during the monsoon, such stems break.

To get over this problem, leafy trees should be grown on the south-western side of the plantation, and the stems of unaffected palms protected with areca leaf-sheaths.

If a few of the trees have been damaged already, split pieces of areca stems should be tied around the stems of such trees. This will protect them against heavy winds.

MORE EGGS PER YEAR

The earlier a pullet starts laying eggs, the better always will be her total annual egg production. This is the opinion of the poultry experts at the Izatnagar Veterinary Research Institute.

Another finding at the Institute which will be of interest to all poultry-keepers is: to have good-sized eggs, the breeding stock, especially the females, should be selected with consideration to their body-weight. A 24-week old White Leghorn pullet should weigh $3\frac{1}{2}$ pounds and a Rhode Island Red one, $4\frac{1}{2}$ pounds. Such birds usually lay standard size eggs, a dozen of them weighing 24 ounces or more.

For those in the table egg business, here is another useful hint from Izatnagar: it is economical to keep Rhode Island Red and White Leghorn birds only for ten to 12 months from the time they laid their first egg, because in the second year the number of eggs laid goes down by a fifth.

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THIRTY chicks and sixty eggs of the White Leghorn breed: this is what started Shri Rambhau Kharat of village Sonake in Bombay State on the road to prosperity in 1940.

"Till then all I did was to struggle with my six barren acres and thirty poultry birds of a nond-script breed to make both ends meet," said Kharat, whose farm I visited recently. Today, thanks to his switch-over to White Leghorns, he has 73 acres of cultivable land and a poultry flock that brings him a comfortable 1,200 rupees a year. There was quite a set-back to his flock a few years ago, I was told, due to Ranikhet and a severe famine, but he was slowly making up.

Kharat has bagged the shield for the best poultry breeder of the tract for the last six years. He wins a number of cash prizes every year in poultry shows held in the State, and "I consider the Rs. 300 to 400 made in this way also a return from my flock," he put in good-humouredly. With a little touch of pride he added that his eggs and birds reached every corner of Maharashtra and Karnatak.

The Kharat farm is situated along the banks of the village stream, "the holy Ganges of my birds," as Kharat likes to call it. He has planted a grove of *nim*, *babul* and *pipal* trees on the farm. The birds, therefore, have cool shade all around them.

Besides the usual *jowar* or maize, Kharat feeds his birds with onions, and dry fish at least once a week. In summer, he gives them *methi* CONTD. ON PAGE 40

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CONTINUED FROM PAGE 23

daily rise of 2°F up to 68°F as the mean temperature. The eggs are left for about 12 days with the humidity kept at 72 to 75 per cent, and at 75 to 80 per cent on the approach of hatching. Apparently, it is drier in the earlier stage of embryonic development and more moist in the later.

Introducing. Hatching usually takes place at dawn. In spring, it occurs precisely between 7 and 8 a.m. and in autumn, 6 and 7 a.m. For this reason, the time for introducing caterpillars to a tree is generally before 10 o'clock in the morning. It is very inadvisable to introduce them when the temperature in the cocoonery is low. No introducing should be initiated unless the weather is getting warm.

The caterpillars are extremely active. When hatched, they are led to the tree by means of a twig of willow or cedar, five to six inches in length, which serves as an introducer. In introducing, a bamboo wattle or millet straw is lightly laid over the egg-card of tin foil upon which the twig is put. As soon as the larvae come in touch with the leaves of the twig, they are gently transferred into the tray together with the twig. Other fresh twigs are used in succession to mount them on the tree. In case of rain during hatching, the twigs to which the worms are clinging are cut with scissors and put into jars or bottles of water where the worms are reared indoors temporarily. Should the weather permit and the wet leaves dry up, they are sent out to the cocoonery for rearing again.

In Liaoning and Shantung, autumn tasar silkworms are generally hatched and reared in the early and middle parts of August. The method for cultivating the autumn stock differs from that for the spring stock. In the middle of July, the emerged female moths are attached directly to the twigs for the purpose of mating, laying, hatching and feeding on the host plant. The number to be colonized is determined by the food available. As a rule, it is greater in the spring than in the autumn. Usually, a batch of eggs from a single female moth may be fed on ten trees.

Cultural management. *Density of colony.* As the tasar trees vary in age and condition of growth, the number of worms to be fed per tree depends on its size and density of leaves. Generally speaking, a medium-sized tree two or three years old may be used to feed a group of 60 to 80 caterpillars. Caterpillars after the second instar should gradually be thinned out to not more than 30 to 40 to a cocoonery which was provided inclusively for the stock in the second instar up to the fifth molt.

The foregoing limit of colony is mentioned only for reference. For practical purposes, it is varied in regard to the local conditions and development of the native individual trees.

Trimming and transfer. This is a special practice in rearing tasar silkworms. When a mature leaf grows stale or is exhausted, or its quality is poor, the caterpillars are to be transferred to fresh foliage. The time of transfer is preferably before 10 o'clock in the morning when the dew is over and the temperature is not high, or after four or five in the afternoon. No transfer of caterpillars should be done at noon, as the high temperature will necessarily affect the physiology of the stock.

The frequency of transfer is varied in different localities and determined by existing local conditions. In the spring, during their younger stage the caterpillars are generally transferred once an instar, i.e., prior to the first, second, third and fourth instars, and at the fifth molt when their appetite is good, transfer should be made respectively. Caterpillars when fully developed must be transferred to the cocoonery. Sometimes, a supernumerary transfer is required in the adult stage. But too many transfers would inevitably cause a decrease in the number of caterpillars. Proper observation is specially important, since the percentage of cocoons otherwise would be reduced.

Setting caterpillars. This refers to transferring caterpillars from an old tree to a fresh one. The number of caterpillars to be set is governed by the sizes of the tree and the density of its leaves. Definite technique in handling is necessary. In setting, both ends of the old twig should be closely attached to the fresh one in a criss-cross position. When the wind blows, the old twig should be placed in the centre of the tree. The distribution should be made as evenly as possible. The old twig should be left on the fresh one for about half a day. After all the caterpillars have found their way to the fresh leaves, the old twigs must be removed promptly so that proper ventilation may be provided and pests controlled.

Management and protection. During their young stage, special care must be taken to protect the caterpillars from wind and rain. The cocoonery should be sheltered from the wind, and the twigs bundled up so as to prevent the wind from moving individual caterpillars away from the tree. The most proper way of cultivating tasar silkworms is to feed those in the first instar indoors, then transfer them to the cocoonery as the second instar takes place. This protects them from getting lost.

To protect the caterpillars against epidemic diseases and enemies, it is of primary importance to pay

particular attention to the selection of the cocoonery, to feed the caterpillars carefully and to distribute them very thinly. Moreover, precaution must be taken to keep the tree clean, to see that faeces fall to the ground, to eliminate pests, and to reduce the chances of epidemics. If an occasional caterpillar does get sick or dies, it should be burned immediately together with the twig to which it is attached.

To safeguard the caterpillars from epidemic diseases and enemies, it is desirable to keep the cocoonery thoroughly clean. It is best to spray insecticide before setting caterpillars so that enemies, if any, may be destroyed. Caterpillars when mounted should be thoroughly protected. Pests of any kind must be caught and birds driven away. It is imperative that the loss of caterpillars be minimized in every possible way to insure satisfactory output.

Spinning and collecting of cocoons. The cocoonery selected for spinning must be a tree that affords an abundance of leaves and perfect ventilation. Of the utmost importance in rearing caterpillars is to keep track of the stages of their development. There are disadvantages from transfers which are too early or too late as well as from overcrowding or too sparse distribution of the caterpillars.

The most appropriate time to collect cocoons is about seven days after spinning. Efforts have to be made to enable some cocoons to spin earlier and others later to facilitate collection. The preferable time for collecting is early in the morning 8 to 10 a.m. and after 3 o'clock in the afternoon. At these times, the weather should be fine. Cocoons collected must be taken to the nursery outright. The best ones are selected as breeding stock and the remainder is marketed.

Protection of breeding stock. The overwintered breeding stock of the univoltine is called the spring stock and that of the bivoltine, autumn stock. Upon arrival at the nursery the twigs with cocoons are shaken out. When dried, leaves are stripped off and imperfect cocoons, both fragile and rotten, are picked out. The hibernated bivoltine are then placed in the containers, between 1,500 to 2,000 cocoons in each. Cocoons for breeding purposes are lightly dispersed on racks, two to three feet from the floor, and kept in a clean place. They should be turned over occasionally so as to prevent them from overheating. In the Yangtze Delta, they pass into the pupal stage under natural temperature until early December. The constant temperature for protecting the hibernates is preferably 0°C. It should be heated up to 0°C when below -5°C. The hibernated univoltine are gathered at the end of summer and in the beginning of autumn, when the temperature is very high; so the adjustment of both temperature and humidity is of the first importance. After autumn, they are to be protected in the same manner as the bivoltine.

Breeding. As has been mentioned above, some tasar silkworms are single brooded or univoltine, others bivoltine, or occasionally tetravoltine. Breeding in spring is performed by warming the hibernated stock of the previous year in a warm room in early or late February to accelerate pupal and moth development. The increase of temperature depends upon the natural temperature at the time. Ordinarily, the starting point begins at 58°F with a rise of 1°F every other day. After two weeks, an increase of 1°F daily till 68°F, with humidity 70 to 75 per cent, is reached. This is held as the mean temperature till emergence occurs. The length of time taken for emergence is approximately one month in Kiangsu localities and about 40 days in Shantung and the North-east.

The male moths are primarily selected soon after emergence from the cocoons and at the time when their wings have spread and become hard. Sound males are selected and put into trays with covers, each containing about 120 moths, and placed in the region where the temperature is relatively low. Then the female moths are captured. As soon as the wings of the females have sufficiently expanded, the act of mating takes place at night (between 11 and 12). The mates are to be segregated around 3 p.m. the following day. The coupling lasts approximately 12 to 16 hours. Subsequently, the selection of female moths is made by a naked eye examination, known as "selection of segregated pairs." This process is rather strict and requires certain training. The general criterion is: both wings fully-scaled and neatly formed, abdomen swelled though barely discernible, segments conspicuous but not corpulent and with no dark brown spots, and eggs plump in shape. Such a female moth may be kept for breeding purposes.

After the female moths are selected, they begin to lay eggs. One way is to set the females in satchels so that the moths can be microscopically examined readily; eggs deposited by the diseased ones can be removed and epidemics controlled. Eggs collected in this manner are, for the most part, stored as breeding stock. The other method is to have the females scatter eggs for general rearing purposes on sheets of paper.

In the first case, the satchel is made of kraft paper or newspaper in the form of an envelope ten to 12 c. On either side of the envelope, several small holes are made for ventilation purposes. The moths are placed in folded and sealed envelopes which are strung together and hung up for oviposition.

In the other case, the female moths are distributed to lay eggs in a round bamboo basket, 12 c. high and 40 c. wide. It holds a 100 moths. The temperature for egg-laying is best at 68 to 70°F, with humidity 75 per cent. When laying is complete, the eggs are stripped off the basket, and such dirt as hair and urine sticking to the eggs is washed off with clean water. Then they are immersed in a solution of two per cent formalin for disinfection. The temperature of the solution is 68°F. Having been immersed for 30 minutes, the eggs are taken out and bathed again in pure water until no smell of formalin is detected. Then they are dried on tin foil, packed into egg-boxes, kept in low temperature until they are to be incubated 12 to 14 days before the leaves of the tasar trees sprout.

BIOLOGICAL CHARACTERISTICS

The most important biological characteristic of the tasar silkworm is its voltinism. This species is univoltine, bivoltine and tetravoltine as a result of its easy assimilation with environmental conditions. So far as the distribution of the producing areas in China is concerned, the race reared in such provinces as Kweichow, Szechwan and Honan is univoltine, while that in Shantung and Liaoning is bivoltine. Suppose the bivoltine of Shantung and Liaoning were transferred to Honan and Kweichow, part of their descendants would become univoltine. On the other hand, if the univoltine raised in Honan and Kweichow were transferred to Shantung and Liaoning, the bivoltine would likewise occur.

What affects the voltinism in tasar silkworms has not yet been scientifically established. Professor Koo Chin-hung, the celebrated sericulturist of China, made a profound study of voltinism of the tasar silkworm in 1941. He ascertained that the variation of voltinism in this species is due both to the length and the duration of sunlight to which the silkworms are exposed at the given moment. It is obvious that the duration of natural light affects particularly the fourth and the fifth instar caterpillars. A number of Soviet sericulturists also have tackled the problem of voltinism. The studies made by Andrenova, Penichi, Denilifsky and Belov also show the specific effect on the voltinism in this species of the photoperiod, i.e., duration of daily exposure to light.

The most significant study on the effect of photoperiod on the tasar voltinism has been carried out by Belov. He has arrived at the conclusion that if the amount of exposure to natural light is less than 13 hours, the caterpillars will develop into dormant pupae without undergoing another larval molt, thus producing univoltine. On the other hand, caterpillars exposed to natural light for 14 to 15 hours will be induced to become restless pupae with a further molt, thus producing bivoltine. This confirmed Professor Koo's conclusion: "As the time of rearing tasar silkworms in Liaoning and Shantung is just around the summer solstice, the day is long and the sunlight strong, thus resulting in the bivoltine. In Honan and Kweichow, the climate is warmer than that in the northern part of China; hatching occurs earlier and the day is short, the fourth and fifth molts take place in the middle of May or about three weeks from the summer solstice, thus bringing about the univoltine."

This point is confirmed by Belov. He indicated that in summer and autumn, if the length of exposure to natural light is prolonged one day, the pupal stage of the second generation in autumn may disappear. In other words, the original bivoltine may be induced to become tetravoltine by taking a longer exposure to natural light. Such artificial and purposeful transformation has been made by the Sericultural Institute. In 1955, the Institute exposed late autumn silkworms to natural light for 18 hours. As a result, all of them become pupae without hibernation (tetravoltine), while those hatched under ordinary conditions are all resting pupae (bivoltine). This proved Belov's conclusion.

In addition to the effect of exposure to natural light, the other important environmental factors that act directly on voltinism are temperature, humidity and feed.

In short, voltinism of the tasar silkworms is inconstant and is readily affected by environmental factors, typically the photoperiod. Nevertheless, the way to control voltinism has not yet been solved thoroughly and awaits further study. This is the most vital problem for production and is a worthy and urgent task in the field of biological research.

CONTINUED FROM PAGE 36

FARMERS I HAVE MET

leaves, green onions and coriander at least twice a week. To avoid excessive inbreeding and to introduce fresh blood into the flock, Kharat occasionally imports eggs and cockerels from other good farms of the area.

A constant companion of Kharat's poultry birds is a family of one male and four female guinea-fowls. "They are valuable chaperons of my birds. In case an intruder like an eagle, mongoose, cat or wolf attacks the flock, they bring the whole farm down with their loud cackling till one of us runs down and drives the menace away," he added, laughing.

—**G.D.B.**

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