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Farming will never be a success unless the farmer had more voice in the disposal of his produce—P. Morrel.

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PURE PADDY SEED AND HOW THE RYOT MAY KEEP IT PURE

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For many years the Department of Agriculture, Madras has been distributing purified paddy seed, but the demand has almost always exceeded the supply. The Department is always blamed because it cannot produce enough seed, and is again blamed when, after a year or two, crops appear mixed. It would be better for those who complain to look further into their own side of the question of pure seed than blindly to throw the blame on to those whose labours are primarily involved in the provision of good seed stocks; and a little more attention to the care of the crop would make it possible for more cultivators to raise their own seed stocks and thus solve the difficult question of supply and demand.

1. Importance of seed purity

(a) Let us first examine the importance of seed purity. A pure strain of paddy, such as *G.E.B.* 24, *Co.* 3, *Adt.* 1, etc., is the result of many years of patient work. A minimum of five years is necessary to produce such a strain, and most of them have taken much longer. Inattention at any stage would upset the whole train of work; it is therefore very unlikely that the very officers who are concerned most with purity should be responsible for the "degeneration" and "reversion to type" that

are all too frequently complained of by cultivators who grow these strains.

(*b*) The maxim of the Department in raising seed stocks is absolute purity. This is, of course, impossible to maintain anywhere in the world, but counts of many samples have shown that the purity of the Coimbatore and Aduturai strains is over 99 per cent. Supposing a single seed of a foreign type were to enter a sample prepared for sowing. That seed might not germinate, but if it did it would produce a plant which might bear from 300 to over 1000 seeds. Taking the lower figure, there are 300 potential plants. Supposing only one-tenth of these to be sown, 30 plants would be capable of producing 30 times 300 seeds, or 9000 potential plants. Perhaps 30 plants in a field might escape the eye of a cultivator, but in the next season (again supposing only one-tenth of the adulterating seed were sown) 900 plants would be at once visible. The sudden jump from an invisible 30 plants to an easily visible number of 900 (27,000 in the following season) is the obvious explanation of the ryot's surprise when, from an apparently pure crop of one year, he finds his next crop badly mixed. Clearly it is not possible to lose any time in getting rid of the stray plants, or *rogues*, and the English maxim " One year's seeding is nine years' weeding " is as true of stray plants as of weeds. The war against stray plants that adulterate the sample and pull down the yield must be waged each season rigorously, or the impurities will multiply so rapidly as to get out of hand. This point is treated more fully later on —paragraph 3 (*c*).

(*c*) Another very important argument in favour of purity is that, if more cultivators were alive to the necessity of maintaining pure seed stocks, it would not be necessary for them to come back to the Department of Agriculture every year, or two years, for fresh seed. The Department of Agriculture will never be able to supply fresh seed to all those who apply, and if more people who have once had a supply would look after their own seed stocks more carefully, the Department of Agriculture would then be able to distribute its stocks to new people each year, and so the improved seed would spread more quickly. Thus ryots who make a habit of applying each year for fresh seed are thereby hindering other ryots from getting their supply.

(*d*) Pure seed means pure crops; pure crops mean uniform germination of a high order, leading to uniform growth (all the plants of a field coming up together, flowering together, ripening together). Attacks of disease or pest so common when patches of plants ripen one after the other are reduced to a minimum. Irrigation is made as simple as possible, and there is a minimum of loss at harvest because all the grain can be taken at once. Thrashing is made easier, as all the grains are at the same stage of ripeness. The resulting uniformity of grain commands a better price in the market. The ryot who follows the suggestions given below can sell his produce for *seed*, thereby commanding at every stage pure seed at an advantage, and the little trouble that is necessary in maintaining the purity is amply repaid.

There are many reasons why seed purity is essential to those who wish to get the best out of their lands, but enough has been said to show the importance of this side of the question, and we may proceed now to examine the stages at which impurities may creep in and see how far the dangers may be removed by methods within the scope of any cultivator.

2. Source of seed

(*a*) We may conveniently begin with the purchase of seed. Since the Department of Agriculture cannot supply fresh seed to every applicant each year, the best alternative is for the landlord to get seed from his own fields. Only then can he be satisfied that it has been freed from stray plants during growth, harvested at the right time and not allowed to get wet, properly cleaned and dried, and carefully stored. These, and many other details, are all important in dealing with grain kept for seed purposes. The next best source is a dealer who specialises in raising seed, or who buys up stocks from approved growers. Such men do not appear to exist in this country, and the landlord who finds himself short of seed, or who has suddenly to find other seed when his newly sown crop dies out through drought, has to depend on the merchant who is collecting grain to sell to the mills for food purposes. This grain has been collected from many sources, types being mixed if they look alike, the criterion of mixing being decided by the price the miller is prepared to pay. In other words the merchant collects his stocks for food and not for seed, and if they should subsequently be used for sowing, the crop is almost bound to be a mixture of types. But the argument that should appeal most strongly to the cultivator is that a loan has usually to be raised to buy from the trader whereas seed stocks kept from one's own fields need no such loan. Conditions being so variable in different parts of the Presidency, it is not possible to dilate on this point in this note.

(*b*) In cases where it is not possible for a cultivator in a small way to keep seed from his own stock, he is often prevented from going to his neighbour by a strong prejudice that makes him mistrust his fellow cultivators. This inherent mistrust is a great hindrance to the spread of "improved" seed, but it would naturally disappear if more cultivators could be made to understand the reasons why purity is important and how it can be assured.

3. Seedbeds

(*a*) These may be prepared either wet or dry. Although dry seedbeds offer certain advantages in some districts, and may even be essential, they offer a fruitful source of mixture of seed. Cattle are commonly tethered on ground intended for the dry nursery, and paddy straw is used as fodder. As this straw has, in the majority of cases, been cattle threshed, it usually contains odd grains, and these may easily establish themselves in the ground and come up with the subsequent nursery seedlings. As in some districts the cattle are kept only for the cultivation and threshing seasons, being either sold or sent elsewhere for grazing for the rest of the year, they must be fed somehow, and this is a sore problem in deltaic tracts having practically no poramboke land. But if the idea is to manure the nurseries, and there is nowhere else to tether the animals but on the fields, it would be better to choose a field intended for transplantation than a nursery, and to cart the manure to the nursery afterwards. The nursery would lose the liquid excreta of the animals, but it would be much cleaner. Contamination is more important in a nursery than in a transplant field. For, in the case of a transplant field, there is no movement of stray plants. Seedlings are put *into* the field from the nursery, but no plants are taken *out* to other fields. Consequently contamination from stray grains shed from the litter or fodder, if it occurs, is confined to the place in which it

occurred and any stray plants can be easily seen and removed if necessary. The case of the nursery is far different. If the cattle were tethered on a nursery plot and stray plants result, these may be taken with the seedlings raised in the nursery and so may find their way to any part of the holding at transplanting time. The labour of removing them from this wide area is then considerable, and may be impossible. Hence the importance of keeping the nurseries clean. Paddy straw intended for feeding on the fields should be stacked, as there is then the possibility that the vitality of any stray seeds may be destroyed by the natural heating of the stack. The practice of stacking paddy straw and sunhemp straw in alternate layers, common in the Godavary districts, is good in that the stack heats up to just the right extent and minimises the danger of stray grains sprouting. Referring back to the question of carting manure on to the nursery, the best practice—better than tethering—is to confine the animals to a definite spot where good cattle manure can be made. Fresh litter each day should be given to soak up the liquid excreta, and the mass of straw and dung allowed to consolidate and become well rotted. This makes the manure easily available when applied to the nursery and eliminates all risk of stray seeds germinating, as these are killed out by the heat.

Sheep and goats, which eat what they can find but receive no extra fodder, can safely be tethered on the fields, provided there are no late tillers of paddy bearing seed which may again be voided by them.

(*b*) Sweepings from the threshing floors are often added to the nurseries. Though the idea underlying this may be to increase the organic content of the soil and so to improve its texture and fertility, it is a bad practice. These sweepings are full of stray grains and probably contain weed seeds, seeds of other plants, diseased chaff, etc. They are much better burnt, and the ash may then become a useful manurial dressing.

(*c*) In the dry seed beds of Malabar, seeds of the first crop shed in one year are liable to remain and sprout in spite of all precautions. It is said that these seeds survive the immersion of the 2nd crop and sprout with the first rains after the second crop is harvested. This is a little difficult to explain, but if it is found to occur, the " voluntary " seedlings so produced should either be ploughed in, or collected and transplanted separately, (as there is a tendency to prefer these voluntary seedlings for transplanting owing to their better growth—possibly a result of their wide spacing). This is a difficult question as it is often impossible to obtain water in time for first crop nurseries, and dry nurseries become a necessity. Stray seeds of the second crop do not appear to cause trouble, and if the nursery for the first crop is laid down in a field that was growing the same variety in the previous year, there is no particular danger in the " voluntary " seedlings, as they are identical with the mass. The remedy here lies in using one nursery for the same variety, year after year. If this is done, much of the disadvantage of the dry nursery disappears.

(*d*) In deltaic tracts under canals or channels where advantage must be taken of the first flush, wet nurseries are commonly sown all over the tract at the same time. Usually corners of fields, or fields in compact blocks, are taken, and field-to-field irrigation is the rule. As every one is clamouring for water at the same time, no precautions are taken against washing seed from one field to another. If all the nurseries are of the same variety, the damage due to such washing away of seed may be slight;

but as all varieties may be sown together, in contiguous nurseries, mixtures are bound to occur. The remedy is easy if the disposition is planned beforehand. The position of the fields that can be used as nurseries is fixed in relation to the source of water, but what is usually at fault is a lack of system in separating varieties. Where nurseries are raised on a large scale and the seedlings are sold to other ryots at varying distances, the danger is minimised; when the nurseries are necessarily small, a little co-operation amongst the cultivators along the same channel could prevent any danger of mixture.

(*e*) In broadcasting seed for the nursery, or, where transplanting is not practised, for the main fields, the ryot usually likes to get into every nook and corner of the field and to sow each small field channel, and in his zealousness a little seed is blown over the bund or is washed along the drain into the next field. This is another common source of mixture, and the remedy, if purity is realised to be of importance, is to discard all seedlings in a band at least one yard wide all round the field. These border seedlings may be used for transplanting into fields that are not intended for seed, but for seed purposes only those seedlings from the centre of the nursery, which are beyond suspicion, should be used.

(*f*) In cases where several small plots of different varieties are sown in the same nursery field (an example of this is to be seen in many cases where small quantities of different strains from a Paddy Breeding Station are being tried) the little patches of different seeds are demarcated by clods of earth or twigs lightly stuck into the ground. These are easily moved or washed away and the confusion which results is a certain cause of mixture. Then there is a complaint that the seed stocks were impure! The same condition arises when surplus seedlings of different strains or varieties are transplanted in plots along with the main bulk. The plots are again demarcated by mud lumps. The remedy is to use some more permanent boundary, such as a field drain or a bund, and the importance of leaving a reasonable space between nurseries of different sorts of seedlings cannot too strongly be stressed. *It is not a waste of* space. *It is an insurance.* A space of two feet is quite sufficient in a nursery, with reasonable care, to minimise the danger of mixing.

(*g*) In many cases (particularly on the West Coast) deliberate mixing of seed of similar varieties goes on, as this practice is said to minimise seasonal effects and ensure at least an 8 anna crop in bad seasons. It may. But a maximum crop is never attained. Examples of this custom are *vettuvari* and *vattan* in palliyal lands (single crop), and *velutharika zhama* and *aryan* in double crop lands. Such crops should not be used for seed. Nor is it certain that the custom has much to recommend it.

(*h*) When seedlings have been pulled out for transplanting, the nursery is hurriedly cultivated and some seedlings are replaced. Stray seedlings may, however, persist, and if several varieties were grown in the nursery these may be a source of contamination. Cases where this occurs are not frequent, but in no case is it wise to use a nursery for the source of seed stocks, and the subsequent cultivation will have removed the danger in time for the next crop. As far as possible the position of the nursery should remain unchanged year after year when paddy follows paddy with no rotational crops. Not only will the fertility of the nursery block be maintained and built up thereby, but the risk of contamination

by stray seedlings is lessened by the extra attention that is given to nurseries.

(*i*) The danger of "voluntary" seedlings mentioned above in dry nurseries is not so great in the case of wet nurseries. If water is available the best method of cleaning up fields suspected of harbouring stray grain is to plough and let in water to soak the field for three or four days. As the water dries out the grain will sprout. Some grain will take longer and at an interval of at least a week should be allowed so that all seed has a chance to germinate, and then the plough should again be taken in. The seedlings will soon decay and the danger is removed.

4. Transplantation

(*a*) Fields to be used for planting should, where possible, be freed from shed grains by germinating the grain and ploughing in the seedlings just as for seedbeds (see last paragraph above). This may not be practicable over the whole area, but it is particularly important for the portions set aside for seed purposes.

(*b*) One nursery may be sufficient to plant up the holding, and seedlings from another nursery—and quite possibly a different variety—are frequently used to fill up fields without leaving any space or boundary. This is unfortunately, only too common in the initial stages of trying out strains from the Paddy Breeding Stations. So heavy is the demand for seed that applicants usually have to be content with only a portion of their order. This means that they must fill up their fields with other seedlings, but in the process the dividing line is not kept and the whole field is harvested together. The result is almost certain to be a mixture of types and again the blame for the mixed crop is put at the doors of the Department of Agriculture. The remedy is simple and consists merely in separating the different types by drains or bunds, and harvesting and threshing them separately.

(*c*) Another result of this mingling of types in the same field is the possibility of natural crossing occurring between plants where the two types meet. The seed of that generation will escape detection, but the plants of the next season will show a "degeneration" and again there will be an outcry that the seed was not pure. For food purposes a small amount of crossing is of no consequence, but for seed purposes (and even for food purposes if seed is kept year after year for sowing in the same fields) it must be avoided at all costs. The remedy lies in discarding (for seed purposes) a border of at least three feet in each type, i.e., a band of six feet where two varieties touch. The grain is saleable for food but the seed grain must be harvested and threshed separately. Although the amount of cross fertilisation that occurs naturally is very small, it is constantly going on all round us, and it is just as well that we should all know something about this rather technical subject, so that we may recognise hybridisation as a constant source of contamination (and generally, when uncontrolled, "deterioration") and see how it can be avoided.

An actual example will be the best explanation of the course of events. It must be common knowledge to all who deal with paddy that some plants pass from the green stage to ripening gradually, with merely a change of colour from green to straw, buff, brown, etc. Other plants show pigmentation of one or more parts (e.g. glume, axil of leaf, leaf

sheath, node, stigma, etc). A field of plants tipped with purple is quite conspicuous and not at all uncommon. Consider what happens when such a field is growing next to a field of a pure green variety. As a rule, each paddy flower is closely self-pollinated, and by the time the six anthers and the two feathery stigmas are visible, pollination has been effected. The anthers may not, however, shed their pollen until five minutes after they appear, and in very unfavourable conditions, such as dull weather, the anthers and stigmas may be outside the glumes for much longer without pollination occurring. It is therefore obvious that there are distinct chances that pollen from one flower may find its way on to the stigma of another, and so effect a cross.

In our fields of purples and greens, if there are stray plants at the edges that have lodged and so become intermingled, it is quite possible for crossing to occur. Suppose pollen from a green plant has dropped on to the stigma of a plant with purple tipped glumes. There will be no external evidence. The grain will set normally. If it is sown in the next season the resulting plant will have purple tips, and will be indistinguishable in this respect from the pure purples. In the second year the case is quite different. The first generation (F. 1) plant may have produced 500 to 1000 or more grains. (On the Paddy Breeding Station, F. 1 plants have been grown bearing upwards of 10,000 grains). If 500 of these grains are sown and produce plants, there will be approximately 375 with purple tips and 125 green throughout. In future years there will be a constant splitting of the hybrid purples in the ratio of 3 purples to 1 green. It is therefore obvious that contamination due to such crossing may escape attention in the first year, but, once established, it is extremely difficult to arrest. As it may occur every year round the borders of fields, the remedy should be obvious—grain for seed purposes should always be taken from the centre of the field, away from all danger of contamination, and it must be thrashed separately and treated carefully at each stage to ensure purity.

The case of purples and green is very easy to detect. But other crosses are much more insidious and may go undetected for several seasons. The chances of such contamination being annually recurrent, this should be a sufficient argument in itself for a continued effort towards maintaining seed purity.

(*d*) The advantages of transplanting over broadcasting are many, but one that is not often thought of is that there is much greater control over the mixing of strains. If seed is broadcast in a field which already contains stray seed, both the broadcast and the stray seeds will grow up together and there will be no chance of separating the mixture (unless there are obvious differences at some stage of the crop which make a laborious hand picking possible). If, however, this foul field is used to receive transplanted seedlings, there will, from the start, be a difference between the seedlings already equipped with leaves and stray seeds that may eventually sprout, and therefore it is easy to destroy the stray seedlings. The extra space between seedlings of a transplanted crop makes this separation still easier.

(*e*) If a block of transplanted or broadcast crop dies out from any cause, e.g., a water pocket resulting from faulty levelling, crab damage, etc., and the nursery is empty, it is better to pull out seedlings from the same field to fill up the gaps than to take seedlings from some one else's

nursery about which little is known. Exchange of seedlings is very common in some of the larger deltaic tracts and is the cause of much mixing.

5. Growing Period

(*a*) The ryot naturally wants to use every square inch of his field and looks with disdain upon our " stupid " practice of walking into the fields and pulling out stray plants. It is all a question of view point. If the crop is for feeding only, a hurried glance at any bazaar stall retailing rice will show that a slight mixture of grain has but little bearing on the market value. Therefore there is no particular financial advantage in roguing food crops. But for seed purposes roguing is a first essential and neglect of this operation stultifies all our efforts at maintaining purity.

(*b*) It is equally important that roguing should be done by uprooting the whole plant and removing it from the field. Cutting off the vegetative portions with a sickle is of no use as the plants will send up secondary tillers (ratoons) which hurry through their growth and may mature with the main crop. The grain is thus included in the harvest and the work of roguing wasted.

(*c*) Roguing must be carried right through the growing period. It is not a difficult process and an intelligent cooly can be trained to do the work. There is no particular period at which roguing should be done as the difference of growth of stray plants may be more obvious at one stage than another. Thus a first generation hybrid may rush through its early stages and become obvious by its extra height and vigour in the first month. An early, short term variety will be obvious immediately it shows signs of flowering and may easily be spotted amongst the bulk of the rest of the plants that are still in the leaf stage with no sign of flowering. As a general rule the pre-flowering and flowering stages offer the greatest chances of noticing differences. A word of caution is necessary to stop the over zealous from entering a field in full flower. Natural crossing is not common, but the extra agitation caused by walking amongst the plants, and the chance of carrying pollen about on one's clothes greatly increase the danger.

(*d*) Generally speaking roguing need only be done on plots intended for seed. It is always better to do too much than too little and about one-fiftieth of the holding should certainly be treated and this must be done *every growing season.*

6. Threshing

(*a*) The threshing floor is perhaps the most obvious source of contamination. There is no need to advocate expensive floors of stone or cement as the ordinary mud floor can be made quite serviceable in the way common to the country—plastering with cow dung. The chief disadvantage of an earthen floor is that it develops cracks. These should be attended to at once, as they are a source of loss as well as of contamination. It seems unnecessary to enumerate all the good and bad points of threshing floors, but before going on to the less obvious ones, one or two of the more obvious ones may be briefly indicated. Thus a threshing floor should be level and should not be allowed to carry standing water; it should be large enough to allow each variety to be threshed independently of the other; even when it carries all the stacks of unthreshed straw, the space should not be cramped, as the ultimate stacks of threshed straw

will not be very much smaller than the unthreshed ones; it should not be subject to floods at harvest time, nor too much exposed to wind; it should have shade, as the strong sun, besides tiring the animals, is bad for fresh seed; it should not be far away from the fields and it should be watched at night; *above all it should be kept clean.* Cracks should be filled with earth and not with straw, as the straw commonly retains a little grain which then becomes added to that being threshed; but a further large disadvantage of using straw to fill cracks is that it becomes quite impossible to sweep these cracks clean between the threshing of different lots.

(*b*) In some tracts high land for threshing floors is very rare. An ordinary field is then used and this should on no account be put down later to a nursery or should seed bulks be raised on it. The dangers of using it as a nursery are that seedlings sprouting from stray grains are liable, on transplanting, to find their way to any part of the holding and so get hopelessly mixed in. The dangers as a plot for raising seed bulks are too obvious to mention. Such a threshing floor should therefore be chosen only in a field used for raising food crops.

(*c*) In these same districts, because of the shortage of high pieces, threshing floors are used by several ryots clubbing together, and these form a serious source of contamination. Different varieties are all threshed out on the same ground and mixtures, which must inevitably result, thus find their way into the grain of every ryot, and the owner of the field suffers most. It is impossible to stop this system, which is dictated by necessity, and the only remedies are to thresh out seed stocks separately, and to insist on perfect cleanliness (by sweeping after every lot is done, closing up cracks immediately with mud, and by giving the whole floor a further coating of cowdung).

(*d*) Grain intended for seed is often taken out of the bulk after all is threshed. This is a hopeless state of affairs. There are hundreds of agriculturally different types of paddy, but it is not possible to distinguish them all by their grains. Therefore it is not possible to separate them in the mass once they are mixed. The only way of ensuring purity is to stop them getting mixed in the first place. Thus there is only one satisfactory way of saving seed and that is to grow a special plot for that particular purpose. If only one quarter of the ryots cultivating paddy could be prevailed upon to grow special seed plots the difficulty of supplying enough seed to go round would soon disappear. Seed plots should be threshed *first* and, where possible, they should be hand threshed or trodden under foot by the women. In those districts where the seed sheaves are beaten on a board or bench, only the grains that come away with the first beating should be used. Whatever method is adopted, half filled grain, light seeds, etc., should not be used as seed.

(*e*) The threshing floor should be carefully swept and cracks filled up with mud after each lot is finished. This is not much trouble and would save a great deal of labour later on. It is especially important when seed paddy is handled.

(*f*) Winnowing should all be done in one place as far as possible to avoid the distribution of grains that may be light but would still germinate. In a high wind these may be blown about the floor, into the fields, into the heap of threshed grain, etc. Hence the importance of protection from high winds.

(g) In Malabar practically every cultivator has his own threshing floor and here the difficulty is not one of common ownership but rather that one man may deal with single crop, double crop, treble crop, and possibly dry paddy (modan) as well. All these varieties are threshed on the one floor, advantage being taken of snatches of sunshine, and with very little cleaning in between. The remedy here is obviously a closer attention to cleanliness. The case is very complicated at the Agricultural Research Station, Pattambi, where we deal with many more varieties than any single landlord or cultivator. Yet by judicious use of snatches of sunshine, and scrupulous attention to cleanliness of threshing and drying floors, we are able to prevent mixtures. We can do it. So can any one else. It is futile to say that it can't be done.

7. Seed drying

Frequently along the border of a roadside village one sees paddy spaced out on a mat to dry. This may be food paddy being dried for pounding, but is often seed grain. Undoubtedly the drying is necessary but the care taken of it bears no relation to its value. Two mats may touch or two piles may be spread on the same mat. Little or no care is taken to see that the fringes of two piles are kept distinct and mixture almost inevitably occurs, and this is helped by crows and inquisitive dogs, children, and passing vehicles. A properly cow-dunged floor with a certain amount of privacy offers better facilities than a mat in a public highway. The mat is likely to catch grains in its meshes and these grains may become a part of the next pile to be dried. The mat is considerably improved if it is washed over with a thick suspension of cow-dung before use, as this closes up most of the cracks and holes; but, whatever other precautions are taken, the grain should be kept away from public places where there are so many chances of contamination and loss.

8. Seed storing

There are many receptacles called into use for storing seed. One may mention gunny bags, mud pots, mud bins, bamboo bins, wooden bins, *mudikattas* of straw twists, *pattarais* of straw twists, pits, granaries, etc. Each method has its merits and demerits. Thus, gunnies are convenient for filling and they hold a recognised quantity for sale, and are cheap. If care is taken to see that no stray grain has been left behind in the bag before it is used, the gunny makes probably the most convenient means of transport and temporary storage. It is not insect or rat proof, nor is it damp proof, and insects and damp are the worst enemies of stored grain. The gunny cannot be said to be a good receptacle for storage, and it has many disadvantages. But it is convenient, and is in such common use that it is unlikely that it will ever be replaced. Again, the maxim is cleanliness. If the grain is occasionally spread out on a floor open to the bright sun, much can be done to keep the grain in a good condition. Sun light is the best cure for storage ills. Mud pots and mud bins may be made insect proofs by a covering of cow dung. Storage receptacles (pattarais, etc.) made of straw twists are built up as required and dismantled after use, but their danger lies in the introduction of stray grains by half threshed straw of another variety. The large granaries of Godavari, like little houses, are usually kept very clean and each year before

use receive a fresh coating of cow-dung inside and new thatching outside.

Kerosine tins are excellent for small quantities if kept away from changes of temperature. The usual method of opening a tin, by melting the solder from round the small cap in one corner, leaves quite sufficient space for introducing seed after the tin has been thoroughly cleaned. The hole may be re-soldered or replaced by a temporary plug, or a quantity of dry sand introduced over the seed. The crates sold with each pair of tins are useful in transport.

A good method advocated some years ago was a mud bin on a wooden frame. The top is sealed by a layer of fine dry sand and the seed is drawn off through a hole at the bottom. This is illustrated, along with other suggested methods, in the Proceedings of the 3rd Entomological Meeting, Pusa, February 1919, Volume II, Page 712. " Stored grain pests " by Fletcher and Ghosh.

9. Germination test

(*a*) Before any seed is sown it is an excellent practice to conduct a germination test. If, for instance, it is known that a sample will only germinate 50 grains in each 100, it is clearly necessary to double or even treble the sowing rate to get an even stand. As a matter of fact seed so bad as this should at once be discarded unless it can be improved by further exposure to the sun. But an 80 per cent. germination also needs more seed for sowing than a 99 per cent. germination. Bad samples are easily found out in this test. A sample of which the seeds germinate all together on the same day is good, but some samples will spread out over a number of days. The disadvantage of this in the field is obvious and may often be avoided by further drying.

(*b*) A simple germination test may be carried out on 100 grains taken at random and put between cloth or blotting paper which is kept moist. Examination at the same hour each day for three or four days will soon show the rate and amount of germination. Moist sand or earth may also be used, but it is better to do such tests in the dark in such a way that there are no sudden changes of temperature. A square unglazed tile (porous) divided into 100 squares and placed in shallow water so that it is always moist forms a very convenient germination plate, but it should be covered, as light has a definite retarding effect on germination. The method adopted at Coimbatore for paddy is perhaps beyond the scope of most demonstrators but may be briefly described as follows. A piece of blotting paper is ruled into 100 squares—10 each way—each to take a grain of paddy. The paper is placed on a tray of perforated zinc which, in turn, is enclosed in another zinc tray containing water. Strips of blotting paper are laid between the ruled paper and the first tray and these dip down into the water to keep the whole moist. A lid is provided and aeration is given by series of holes in the sides of the outer container and the inner tray. The complete set is placed in an incubator at a constant temperature, thereby simulating conditions of normal germination. Counts are taken daily and the seeds are removed as they germinate.

10. Conclusion

The purity of a crop can only be kept up by incessant care. The above notes touch on several points where contamination may easily

occur, but a little thought will extend this list greatly. Fortunately it not necessary to apply these precautions to the whole of the crop. Few cultivators will require more than one fiftieth to one hundredth of their holding for raising seed for their own use, and attention should be concentrated on this. In any field from which paddy for seed purposes is taken, whether it is a special seed plot or an ordinary field, the borders should always be harvested separately and used for food; only the central portion of the field, about which there is no fear of contamination, should ever be taken for seed. At other stages, such as threshing, particular care is again needed for the seed paddy, though nothing has been advocated above that might not easily be applied to the whole crop with advantage.

If it could be said that, in each taluk, there were three cultivators in a fairly large way who could be relied upon to raise pure seed stocks each year, there would be no more difficulty in meeting all the many demands for good seed. The Department of Agriculture will never be in a position to sell seed to all who wish to grow our strains, and the most satisfactory way of making the supply meet the demand is to increase the indigenous supply!

GROW YOUR OWN SEED

STUDIES IN THE COST OF PRODUCTION OF CROPS

(*Continued*)

By D. G. MUNRO

IV

Name of Crop:	Paddy.
Area:	4 Acres.
Locality:	Seshanchavadi Village (Salem Taluk).

The paddy crop was raised in wet lands commanded by a tank. Irrigation was supplemented from wells. The ryot besides cultivating his own land cultivated the land of another landlord on *Varam* system. As usual the ryot's own cattle were used for mhoting purposes. For ploughing hired cattle were supplemented. Being a small landholder the maintenance charges of cattle were not high as the cattle were often grazed by the boys of the farmer. Extra ration, viz., concentrated food was given to the mhoting bullocks. Season was not favourable. A portion of the land was sown broadcast while the remaining land was transplanted with seedlings.

As there was no water in the tank the cultivation of a portion of the land was done solely with the help of the well water. One month later, the tank got supply of water, and the cultivation was started, and seedbed sown on 30th July, but the ploughing was started only after 45 days. The age of the seedlings was 60 to 65 days at the time of planting. All the fields in question had the benefit of the water from the tank for one month—two varieties of paddy were sown—each five and a half months in duration.