

SCIENTIFIC AGRICULTURE IS NEUTRAL TO SCALE—THE FALLACY AND THE REMEDY*

BY

B. SIVARAMAN

*Vice-Chairman, National Commission on Agriculture,
New Delhi*

I feel highly honoured by this opportunity given to me by the Indian School of Agricultural Statistics to deliver this year's Dr. Rajendra Prasad Memorial Lecture. Dr. Rajendra Prasad was a great Gandhian. Gandhiji took him away from a life of great promise as a lawyer and public figure within the then Government frame to initiate him into the problems of Rural India in the Champaran struggle against the indigo planters in April, 1917. Gandhiji created many leaders in New India but there were very few amongst them who tenaciously held to the belief that construction work in the villages for solving the present problems of hunger, poverty and ignorance of the masses was more important than wielding power in the legislatures. Today's problems in Rural India still require dedicated service by leaders of this calibre, if our promises of social justice are to be translated into a semblance of achievement. The establishment by itself has its limitations in handling the complicated social problems of growth that are involved. My talk today will deal with some of these problems of Rural India. It is delivered in the hope that the time will produce the leaders and Dr. Rajendra Prasad's example may light the path to leaders yet unknown to tread this thorny path.

2. There have been assertions from responsible sections of the community that the green revolution has made the rich richer and the poor poorer. It has been pointed out that the larger farmers have visibly benefited by the new technology and the rapid rise in their affluence is obvious for anybody to see. On the other hand, in these regions of development the marginal farmers and the agricultural

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labour have not benefited at all. On this ground there has been a tendency to question the wisdom of the introduction of the ingredients of the green revolution and thereby, in their view, introducing a greater disparity in the rural sector. Faced with these criticisms, there has been a rapid reappraisal of the programmes both on the scientific plane and the statistical plane to enable the planners to take a fair view in the matter. The scientists have analysed the problem from the economics of inputs and services and they have proved that provided the necessary support in controlled water supply, selected seeds, right type of fertilizers applied in the right quantity at the right time and pest and disease control for the local pests and diseases is laid on according to the scientific advice, the return per unit of land is uniform whether the exploitation is on one acre or on ten acres. The area is not a constraint either at the top or bottom level provided the recommended practices are followed meticulously. If the marginal farmers have not got the benefit from the new agriculture, it may be more because they are not able to provide the inputs in time according to the recommendations. If the inputs can be arranged the yield is assured.

3. The statisticians have done statistical exercises on the field conditions in areas where the new technique has been propagated and have come out with, more or less, the same assertion that for participants in the programme the new technology is neutral to scale. The study divides the area into zones and selects suitable villages and arranges the farmers in the village according to the extent of the land held by them. A random selection from about five levels of holdings is made of both participants and non-participants and the individual cultivation accounts studied in detail. Out of these studies the conclusion is drawn that the per land unit return that the participants get has no relation to the scale of the farms. Within each level there are high variations within the participants in the net productivity per acre. The application of fertilisers and pesticides though larger amongst participants than amongst non-participants, is nowhere near the levels recommended by the scientists for maximum returns under the new strategy. The conclusion that these studies draw is also that the strategy appears to be neutral to scale; it is the provision of the inputs and the taking of the precautions which control the per unit production. They also refer the problem to the administrators as a problem of finding the inputs in the right quantities at the right time.

4. The administrator has been supporting the programme of scientific agriculture by organising the extension structure so as to disseminate the new science and demonstrate its advantage. The

administrator has also arranged the necessary inputs and services for the support of the programme. It is the help of this organisational structure which has enabled the large farmers to get the benefit out of scientific agriculture. The extension organisation do not restrict their coverage to only the large farmers. All farmers, large or small, are welcome to the programme. The input supplies are also available for whom-so-ever is prepared to take it. The bottleneck being credit it has long ago been accepted in the cooperative credit theory that credit will be made available to credit-worthy schemes and not necessarily on the credit of the person borrowing. The Commercial Banks have also in their lending programme accepted this approach. When a programme is planned and approved by the extension organisation of the administration it gets the support of the credit structure. With all this, we have noticed that from 1968 onwards the marginal farmers have not benefited substantially from the new programmes. The richer farmers have been able to get more noticeable benefits from the new agriculture. The administrators feel that it may be that in a programme covering both large and small farmers the social structure in the villages may enable the larger farmers to pre-empt the services and the credit and this may be a reason for the failure of the small man to get the necessary advantage. It was, therefore, agreed to create a pilot project of the small and marginal farmers to give them the full benefit of the new science. In the Small Farmers Development Agency, attention is paid to a specific number of families of small farmers who, with the necessary credit and inputs, will be in a position to produce the necessary surpluses to repay the capital instalment and input loans and interest and also retain a sufficient margin to support a consumption which will place them above the minimum need level. A district programme can have as many as 50 thousand families. This programme is based on improved agriculture. In the Marginal Farmers Scheme, the emphasis is on subsidiary occupations in the nature of poultry rearing, milk production, etc. which, if followed meticulously, can give surpluses to the family after repayment of loan instalment and interest. Both these programmes are concentrated on the small and marginal farmers and the agency's main duty is to ensure that the credit and inputs and services reach the participants in time in the right quantity. An estimate of the success of the scheme can be made from the credit impact for the programme. In 1971-72 there were 21.56 lakh families taking part in the programme and the total credit that was granted to them was Rs. 1156 lakhs in long-term and Rs. 1748 lakhs in short-term. This works out to an average credit of Rs. 55/- of long-term credit and Rs. 81/- of short-term credit per family involved in the

programme. As the average acreage of a holding in the programme is above a hectare this amounts to very low investment per acre. The programme of scientific agriculture requires much more than this investment to give any worthwhile or sure return to the farmer. It is, therefore, obvious that in spite of the concentrated attempt to deal with this class of farmers the result has not been spectacular. The administrators feel that it is the credit organisation who have let them down in not providing the necessary credit for the credit-worthy programme.

5. The credit institutions which support the agricultural programme are the cooperatives and the commercial banks. Cooperative credit theory had long ago accepted the principle that credit shall be given on the credit-worthiness of the programme and shall not be limited by the credit-worthiness of the party taking the credit. In the special programme for small farmers and marginal farmers these institutions were given an additional attraction to cover the requirements of the programme by an offer of subsidy of 6% on the loan given by the Primary Cooperatives and 3% to the bank on the amount lent and 3% subsidy to the Land Development Bank on the long and medium term credit given to the small and marginal farmers in the programme. We have also to take note of the fact that on the recommendation of the Mathur Committee set up by the National Cooperative Development Corporation in 1964, a 12% subsidy to the primaries and 4% subsidy to the banks exist for the additional loan facilities given by the institutions each year to this class of creditors. In spite of all this, we have to notice the fact that the credit has been tardy and nowhere near the levels required by the programme. The Commercial Banks have, after an initial spurt of heavy lending to the agricultural sector on individual accounts, found themselves in difficulty in realisation of the dues and have been going warily about their business. The overall conclusion is inescapable that credit for the programme is not forthcoming in the quantities required. Is this due to the lack of credit-worthiness in the programme or certain other environmental factors which we have not so far noticed in our calculations of translation of the laboratory results of the green revolution to the farmer's field?

6. The new agriculture as established in the research centres and translated to selected farmers' fields has shown spectacular yield increases in the cereal crops and also in some varieties of cotton, redgram, soyabeans, moong, castor etc. The various studies made by the statisticians on the field to assess the effect of the green revolution has shown that almost uniformly even the larger farmers do not

use anything like the optimum doses of fertilisers or the full pest control routine that is necessary for the new agriculture according to the research advice. In fact, the economists have already pointed out by macro-statistics that the growth in produce from the acreage of high-yielding varieties is nowhere near the theoretical levels forecast. We are not far wrong in saying that on the field the farmers are reluctant to use high level of fertilisers and pesticide as is necessary for the programme. This is not limited to the small farmers and marginal farmers who may be constrained by the credit situation; but it also applies to the larger farmers who are in a position to command the necessary credit. The economics of the new agriculture clearly shows that the optimum economic limits of fertiliser application and pesticide application is far higher than the levels that have been observed as used by the farmers. Can it be said that the farmer does not want to take more profits? There is certainly some other variable in the field conditions which is preventing the full translation of the laboratory results to the fields. Even with the reduced inputs the large farmers are reaping good profits. There has been no reluctance in advancing credit to the large farmers either by the cooperatives or the banks for the programmes. If the programme is neutral to scale, the small and marginal farmers must be getting even at the lower levels of application a credit-worthy programme with a heavier surplus than what they were used to. If so, how is it that the small and marginal farmers are finding so much difficulty in getting necessary credit to support even the attenuated programmes? Is there something in the field conditions which makes their venture not strictly neutral to scale?

7. Statisticians have already found both by the examination of the statistics of area and production and the micro-field studies of actual field conditions that the farmers are not applying anything like the optimum dosage of fertilisers recommended by the scientists. The farmers are also not using sufficient pest control as the figures of use of pesticides and fungicides make clear. This unwillingness is not linked up with the size of holdings. The micro-field studies show that the unwillingness to invest in the full amount of fertilisers and pesticides required for an optimum crop is also neutral to the scale of the holding. In order to explain this phenomenon, we have to notice another statistical fact which has been puzzling the scientists. We have introduced in this country a programme of national demonstrations in which the top scientists in the agricultural science are expected to take up and demonstrate on a farmer's field the potential of scientific agriculture they are advocating for particular crops. These

demonstrations are always laid down on lands having irrigation support so that moisture stress is not a problem. Incidentally, in many of the demonstrations they are also to show the potential for multi-cropping and optimisation of profit per unit of land according to the latest scientific knowledge. Nearly 2,000 demonstrations are laid down every year, spread all over the country, so that we may say that the programme really represents a sample of the irrigated crop under field conditions in the country. What has been noticed year after year is that, whereas the yield returns in wheat are generally fluctuating within what may be termed normal variations in a crop, the yield returns in rice, jowar, maize and bajra have shown wide fluctuations. The spread of results of production is in too wide a spectrum, showing thereby that there is some factor or factors which have intruded heavily to upset the laboratory situation. We have also to notice that in quite a large number of these demonstrations, the results are not reported. The scientists felt that probably this is due to negligence and that this may also explain away the vast fluctuations in results. Whereas this may be one way of brushing off the problem, it has to be noticed that results can also indicate that under field conditions various other variables are intruding which are not being controlled effectively and the non-reporting may be due to failure of the experiments owing to the other factors. When we add this experience in the national demonstrations to the observed reluctance of the farmers, large or small, to use the optimum amount of inputs recommended by the scientists, it is quite clear that we have to look to identify the other variables which we have not taken note of so far in our calculation.

8. Controlled irrigation or assured rainfall is a pre-condition for the intensive agriculture that is being considered. In our estimates of increased production, we depend upon large areas in the country already covered by irrigation sources. The irrigation facilities are surface-water schemes or ground-water schemes. The latter can be government schemes of tubewells and lift irrigation or private schemes of open wells, filter points and community tubewells and lift irrigation. It is in areas covered by one of these irrigation sources that the national demonstration is usually laid out. The Irrigation Commission (1972) has done yeoman service to agriculture in pointing out that the surface irrigation projects of the country are not in a fit state for supporting the new scientific agriculture which requires controlled irrigation of allotted quantities at fixed times. By and large the surface irrigation projects lack cross regulators in canals to allow for controlled rotation of the watering routine to cover the command

according to pre-arrangement. The headworks generally require modernisation both to avoid silting of the canals and reduction of supplies in the system. The canal capacities have to be duly fitted to the requirement of the crop of the area which they are by no means at present. There is heavy loss in the canal system by seepage so that in areas where water is scarce and precious, the fields actually get only a fraction of the release at the head. In addition, the unlined canals create water-logged conditions in many parts of the ayacut, which conditions are detrimental to the new agriculture or for that matter any agriculture. The Irrigation Commission has pointed out that it is necessary to invest in bringing up these old irrigation projects to a proper shape where they can support the new agriculture. It has been pointed out by a symposium on Canal Lining held in 1960 that merely by lining the canals in the existing schemes it is possible to save precious water and extend the command by another 15 million acres. This incidentally is an additional benefit. It has been calculated that roughly about 600 crores of rupees will be required to bring all the major and medium surface irrigation projects to a fit condition to support the new agriculture. Statistically also the finding of the Irrigation Commission finds support in certain micro-studies carried out in the Uttar Pradesh region to assess the present status of surface irrigation, government ground-water irrigation schemes and private ground-water irrigation schemes to support agriculture. The study reveals that if the benefit from the government surface irrigation scheme is one unit, the benefit from a government ground-water scheme is two units and that from a private irrigation scheme five units. This is a statistical exposition of what any farmer in the countryside knows; that he can better control irrigation to his field by having his own irrigation support. A government ground-water scheme is better able to control supplies than a government surface-water scheme. Even then the methods are still so oblivious to the farmers' needs that the benefits that can accrue are not available. Basically, the large irrigation system that we have built up is not ready to support the new agriculture. The cost benefit analysis will reveal that the modernisation of the old system to fit them for the new agriculture and to prevent water losses and land damage by seepage, is perhaps the cheapest method of large scale production increase and that too in the shortest time. Yet we should not be unaware of the views in high places that what is wanted is new projects and we cannot afford to invest large funds for modernisation of the old systems. There is no doubt a political aspect in this, that additional investments in what are already considered pampered areas, is difficult to countenance. On the other hand, have

we really examined the possibility of modernisation by getting a substantial part of the funds from the beneficiaries themselves? For the limited purpose of my presentation, what we have to notice is that it is fallacy to treat the present irrigation acreage as a good ground for the new agriculture and it is still doubtful whether the nation in the near future will modernise the irrigation system to support the new agriculture.

9. For proper growth, the crop has not only to be irrigated on time but the crop has also to be kept free of water-logged conditions and for some crops it is desirable to drain off the water more or less completely on occasions. Water-logging reduces aeration and also leaches down the applied fertilisers to levels below the root system of the crop. Proper drainage system is, therefore, as necessary for the new agriculture as proper irrigation. What is the position about drainage in the areas under our irrigation system and in the assured rainfall areas? Drainage has never been a part of any irrigation scheme. As the irrigation schemes commanded areas where there was already cultivation under rainfed conditions, the presumption was that there must have been a customary drainage system which will look after the drainage of the command under irrigated conditions. There is a fallacy and a mistake in the thinking. The existing drainage may have been sufficient for the normal rainfall conditions of the areas which obviously was insufficient for good agriculture. With irrigation waters added to the rainfall, the drainage has to take out a larger volume in a shorter period of time. It may not have this elasticity. This is the fallacy. When irrigation is introduced in any area, the land becomes valuable. With land hunger all the time in our rural areas, the tendency is for the powerful sections of the area to encroach on the natural drainages and make them into cultivable plots. Thereby the drainage system is blocked at many places. The mistake is in not seeing this. As a result of both these factors, in our irrigation schemes, drainage control has become a problem. In the areas of assured rainfall, the drainage has to be substantial to take out the main monsoon flush. The tendency to encroach on drainages was not related only to irrigated commands. In rainfed areas these drainage lands were sometimes the richest and the encroachment paid handsome profits. The administration had, no doubt, foreseen this tendency and in many States, where drainage may be a problem, there are statutes which declare drainages as public property and there are summary provisions for removal of unauthorised encroachments. The Irrigation Engineers were generally given the executive authority to summarily eject the encroachers and dismantle obstructions. Before

freedom when the Government in power found it necessary to get group support in a period of national upheaval, the local powerful landlords used to do the encroachment with impunity. They were the favoured of the times and above law. After freedom it became the fashion, to establish the new authority of the masses, by the new class of influential people in the rural areas, by copying this vandalism. Drainages have, therefore, to be established anew if the irrigation projects are to give the necessary help to the new agriculture. This has been duly recognised in our planning and in all the new projects drainage is to be a component part of a scheme before it can be sanctioned. What about the old schemes on which we depend for the production explosion from the new agriculture? Here again the basic conflict between further expenditure on old schemes and expenditure on new schemes arises.

10. That the emphasis on drainage is not over-stressed is obvious from the results of the national demonstrations. The crops which have shown the violent yield fluctuations are all rainy season crops and are susceptible to water-logging. Wheat, which is a rabi season crop, under very low water conditions, escapes this hazard. Though rice is said to be a plant which needs large amounts of water, the high-yielding varieties of rice are most susceptible to water-logged conditions and thrive best under water control. Maize is particularly susceptible to water-logging. Jowar and bajra cannot tolerate heavy inundation and heavy water-logging. We will not be wrong in assuming that the varied results in the demonstrations are due to these basic environmental factors of irrigation and drainage.

11. There is another factor which makes intensive agriculture hazardous: Pest and disease control becomes a serious problem when the crop is particularly luxuriant. A good crop is a good base also for development of the endemic pests and give good shelter for a brood of epidemic pests. The scientists have, therefore, prescribed a fairly strict routine of pest and disease control. The statistics show that the farmers, even the large ones, do not use anything like the optimum dosage for the safety of the crop. It cannot be just unwillingness to invest knowing fully well that the hazard of pest and disease damage is really great. This again appears to be a problem of environment. If the farmer or farmers growing the high-yielding crops form an island or islands in the midst of large areas following the traditional farming even if the routine of pest control is followed by these farmers, it can happen that if the neighbours do not take any precautions on their fields for the endemic or epidemic pests or disease, no amount of pest and disease control only in the islands

give any safety to the crop of the new agriculture. The pests or disease may just cross over to the uncontrolled fields and come back to the luxuriant crops when the toxicity of the pesticides or fungicides diminishes. It is not physically or monetarily possible to keep the crop always toxic to avoid pests and diseases. Thereby unless the entire area takes precautionary measures, the protection of only the islands does not give results. This may be a good reason why the investment in the pesticides and fungicides in marginal even by the farmers who practice new agriculture and also why the crop returns are so fluctuating. The administrator has noted these difficulties. Many States have introduced legislation to compulsorily treat an area with pesticide or fungicide to control pests or diseases which may be epidemic; but the process is slow and the powers may be used only when the danger is very widespread and very serious. Such punitive laws are seldom used to support intensive agriculture by a number of farmers in an area merely because they may lose more heavily than their neighbours because of endemic or epidemic pests or diseases.

12. The three hazards of lack of irrigation support, lack of proper drainage and the lack of a comprehensive pest control programme no doubt explains the two significant facts noted by the scientists and statisticians, namely, nonattainment under field conditions of yield results of the scientists on the basis of special demonstrations in selected fields and the hesitation on the part of the farmers to invest fully in the inputs, both fertilisers and pesticides, that are recommended for an intensive programme. So far we have not brought out anything which makes the programmes specially hazardous to the small and marginal farmers as against the larger. It can still be argued that the results must be neutral to scale but the returns may be on the average lower per unit of land. To the physical environment we have to add the social to get at the variants. The irrigation system, which is mainly government provided, is wholly unsatisfactory. The main defects are that the water is not available on time for the various crucial operations of the new agriculture and the quantity of water is also sometimes not sufficient to cover the entire command for intensive farming. In many cases what is assured is merely a protective irrigation where there is great moisture stress. There is in many systems no control of supplies and water runs for those who can take it. In this free for all, the large farmers of the village who are the powerful elements at present in the social structure, manage to grab the lion's share of the available water. The small man will have to wait and, in many cases, where

the water is scarce, they may have to go without water. Between villages the villages which have the stronger leadership manage to pre-empt a lot of the available water and as a result not all villages get a fair deal in the distribution of the water. If to this we add the pre-emption by the large farmers, we can well understand the state of irrigation of the small and marginal farmers' lands. A proper warabandi distribution system as followed in the Punjab and some other parts of the country manages to even out supplies at least between the Kolabas on the canal minors. Even this is known to have been upset by tinkering with the Kolaba size by the influential groups. In most projects there is no identifiable channel system below the minor Kolaba. So even if there is an attempt to distribute fairly in the chuk under the Kolaba, the local powerful men have full opportunity to upset the system. The mal-distribution is not confined to the surface irrigation projects alone. In government tubewells, because the command has always been expanded to an area which is not coverable fairly by the water available, as in Uttar Pradesh, the small man once again is at the mercy of the larger farmers. Private irrigation source is costly and beyond the capacity of the small men except where cheap open wells can be located as in the alluvial plains of Uttar Pradesh. Under field conditions, therefore, the water requirements of the intensive agriculture are not met on the same terms for the large farmer and the small farmer. This is the first variant.

13. Drainage is important. We have already noticed the present situation in the field which makes it difficult to get proper drainage in the commands of our irrigation projects. The danger of water-logging is, therefore, prevalent in many of these areas. As there are no established drainages which can clear the water from every field, the normal practice is to drain the water from field to field. Here again the large and influential farmers in the villages have an edge over the small and marginal farmers. First of all, the large farmers own more than half the area of the village. When they want to drain out their land, they can do so by passing on the water to the land of the small farmer in the neighbourhood. Thereby the small man's crop is damaged without his being able to do anything about this. If the small man wants to release the accumulated water on his land through the big man's land, he can be prevented till it suits the big man to allow the water. Thus in the control of water-logging in the fields, the field situation is such that there is no parity between the small and large farmers. This is the second variant.

14. Pest and disease control is an imperative for the new agriculture. If the pest and disease control is not done on a village basis,

the action taken to protect individual fields will not be fully effective. If a large farmer protects his land, even if there is intrusion of pest from neighbouring lands, the effect will be serious on the borders, but a good portion of his large holding may yet get protection because the border may act as a buffer till the next routine spraying is done. On the other hand, if a small farmer's neighbours have not carried out spraying, his entire field becomes the border and is fully affected. No portion of a small plot can escape the influx. Therefore, in the field conditions the effect of the lack of pest and disease control by the community, acts with varying results on the large and the small farmers who may be following an intensive agricultural programme. This is the third variant.

15. Taking all the three hazards together, we find the explanation for the statistician's finding that the new agriculture on the field has not produced anything like the increase in production that has been theoretically assessed. It also explains why the farmer is reluctant to use the full dosages of fertilisers and pesticides that are recommended. It also explains the possibility of the wide fluctuations in the yields. As between large and small farmers, the field conditions are already very much in favour of the large farmers. The physical and social conditions in the village are responsible for this.

16. In the programme to deal with poverty, we seek to break the vicious circle in the villages by trying to inject credit to the small and marginal farmers on a large scale. The small and marginal farmer will not be willing to absorb the credit unless he is assured that he will be in a position to repay the debt. Contrary to the general impression, the farmer does not like to stay in debt. The credit-worthiness of the programme of intensive agriculture has been estimated in the calculations of the planners, by the yields that have been claimed by the scientists from their restricted demonstrations. It is argued that this proved that the routine is neutral to scale and all that is necessary is to take back from each unit of land a fraction of the additional production for repayment of the debt, leaving an increased income to the entrepreneur than what he was used to harvest from the unit. The hazards of the field conditions, both physical and social, make it prudent for the entrepreneur not to gamble on investing large inputs in the venture. Even in these modest investments, if there were no obstacles to the programme according to the schedule, the programme will be credit-worthy though the per unit returns will be much smaller and the gains to the entrepreneur also much smaller. Based on the high returns expected from the new

agriculture, the programme also seeks to invest in private irrigation sources of the farmer. If the yields had been high, the return of loans was no problem but with lower margins the problem of repayment of the instalment of loans becomes a problem. Wide fluctuations of yields under field conditions show that in some seasons there may not be any return at all. Added to this the small and marginal farmers are always at a disadvantage under the field conditions in getting a fair return for investment. The large farmer may be able to meet his commitment by the overall surplus because of his large holding even though per unit return may be low. The small farmer has not got this cushion. In the initial flush of enthusiasm, the small and marginal farmers may be willing to gamble on the programme, but the hard facts will make them cautious. Not all the shortfalls in lending in the programme may, therefore, be due to the unwillingness of the credit institutions to lend. The capacity of the small and marginal farmers to absorb the credit for his improvement is much less than that for the large farmer. This is the fourth variant.

17. That the new scientific agriculture is neutral to scale and all that is required to remove the poverty of the small and marginal farmers is to provide them the credit and the inputs in time according to the routines prescribed by the scientists is the great illusion we appear to be unconsciously propagating. It is like saying that if wishes were horses beggars may ride. All you have to do is to wish for the horses. The realities of the field situation both physical and social will have to be taken note of, by all planners. If irrigation and drainage can be controlled; if the field channel and field drainage system can be made comprehensive so that the proper warabandi system of irrigation can be worked out and if the whole area can be made to follow the pest and disease control routine according to the requirements of the season and the size of the broods of pests and waves of diseases, it will be reasonable to expect returns much nearer to the scientists' expectations and that on a basis neutral to scale. Can this be done and, if so, what are the methods to be adopted? Will the powerful sections in the rural areas accept the programme and agree to abide by the rules of the game or is this going to be the insurmountable factor in the growth process?

18. Irrigation, drainage, pest and disease control and land shaping wherever the land levels are not suited to the cropping system have all got to be on an area basis and the routine within the area has to be laid down in detail and followed by all meticulously without trying to do down the less powerful sector. The master irrigation system and the drainage system will have to be provided by the State

wherever State surface water schemes and ground-water schemes are in operation. Long ago, the Planning Commission had laid down that the State irrigation system must provide and maintain the canal system up to one cusec flow or 100 acres. In whichever area the intensive programme of growth with its concomitance of social justice is being authorised in the Plan, the charge on the State must be the provision of the irrigation system according to this direction and the improvement of the system to allow for proper control of the water releases in the right quantity at the right time to the area under the programme. As a complementary liability, master drainages must be provided by the State as a first charge for the area starting from a flow of one cusec or coverage of 100 acres and building up to the main drains. This drainage system shall be constructed and maintained by the State. Within the area, the field channels and the drains must be laid out scientifically by the engineers and constructed and maintained by the farmers. Legitimately recovery of full proportionate charges can be demanded from the large farmers in the area for the State investment. For the small and marginal farmers, no charge for the State expenditure must be levied as they have not so far benefited much from the irrigation. Similarly, for the expenditure for the field channels and drains full charges may be made to the large farmers and some subsidy provided to the small and marginal farmers. After the system is complete, a machinery has to be laid down to enforce the irrigation routine and take punitive action against any local powerful interests who may be inclined to harass the small and marginal farmers as in the past. Statutorily there must be a provision to enforce a pest and disease control routine for the entire area according to the expert advice and provision for recovery proportionately from the farmers. Similarly, land shaping shall be based on scientific principles and proportionate charges shall be recoverable. If this is done on an area basis and supported by the necessary credit and inputs, there is a reasonable certainty that the returns will be as forecast by the scientists. The whole scheme will then become credit-worthy and neutral to scale so that the small and marginal farmers may not feel any hesitation in going for the credit and inputs. What is the certainty that the local powerful interest will agree to play this game? We have already noticed that the present situation has led to two factors which reduce the profit per unit of land even for the large farmers who adopt scientific agriculture. Even though the powerful interests may pre-empt on irrigation and drainage even then their returns fluctuate widely and they are, therefore, chary of using optimum inputs. With area control of irrigation and drainage and pest and disease control all these farmers will be able to

invest fully in the inputs and harvest high profits as forecast by the scientists. It is this economic interest which will persuade the powerful interests and large farmers to cooperate in the venture. Such of those as are mischievous by nature and are actually jealous of the small and marginal farmers improving their lot and hence want to obstruct, shall be controllable by statute and by a supervisory organisation of the Government which is placed in the area. This is certainly possible.

19. On the advice of a Working Group headed by Dr. Minhas which examined the implications of the area development programme, pilot schemes are being sanctioned in each State to handle the package approach to the development of the irrigation system, drainage, land shaping and controlling the pests and disease during the cropping programme in about 10,000 acres in the command of an irrigation project. We have also to notice that in 88 districts in the country schemes for the development of small farmers and marginal farmers have been introduced and intensive agriculture under irrigated conditions is an important part of this programme. This large programme, for which more than Rs. 100 crores has been set apart from the Plan finances and for which there is an expectation of an institutional investment of anything like two to three times this amount, in the area development and infra-structure, will have to depend substantially on the returns that can be achieved by the irrigated agriculture. This large programme should, therefore, take note of all the four constraints that have been spelt out in this Address and plan a comprehensive area programme supported by the necessary statutes and administrative aids. The pilot schemes recently taken up to establish the norms for such an area programme will have to be depended upon for improving the approach in the large programme which has been in force for more than two years now. The pilot scheme will have to be intensively tackled and the answers to our administrative and social problems will have to be found within 1973-74, if we are to make any dent in the problem of small and marginal farmers in the Fifth Five Year Plan. Meanwhile, the elaborate organisation we have created in the small and marginal farmers' project, shall not be left idle and shall simultaneously tackle this problem in the project districts. The time constraint is such that we may not wait for perfection.

20. The nation has probably been a little too complacent with its achievement of the green revolution. When faced with the statistical facts of the vastly fluctuating yields and the reluctance of the farmers to use the optimum dosages of inputs, the problem was

sought to be bypassed by trying to prove that the technique was neutral to scale and these statistical facts can only show that the administration has been incompetent and unable to translate the scientists' achievements to the field. Nobody paused to enquire as to why the scientists in nearly 2000 demonstrations, supervised closely by them on good farmers' lands, could not repeat their claims uniformly in the case of rice, maize, jowar and bajra. When the agricultural administrators drew the attention of the planners to the need for a better control on our irrigation system and the lack of drainage the problem is again being bypassed with the argument that we cannot afford to pour more money in infra-structure development in the areas which have already benefited. The green revolution is expected to solve our food problems by increasing the yields in the areas under irrigation at present and the areas that will be added to our irrigation systems in future. The present precarious position of our food supplies and its dependence still on the good behaviour of the monsoon all over the country must make us ponder whether we are not wrongly assessing the national priorities by easily accepting the argument that improvement of the already irrigated areas shall be only second priority and new irrigation schemes must have first priority. To some extent, by recovery of the development charges from the large farmers in the commands of the old projects it is possible legitimately to reduce the States' investment on improvement of the old irrigation schemes, according to the required programme. What is wanted is the will to enforce such a programme. If, as our analysis shows, the present irrigation cannot support the green revolution, we are only deluding ourselves in calculating our production increases on our present irrigation acreages. The cost of setting right the present irrigation systems which will cover about 20.7 million hectares has been assessed at only Rs. 600 crores with, may be, another Rs. 200 to Rs. 300 crores on drainage. With this investment, we also get an additional coverage of 15 million acres. For this expenditure, the new area we can irrigate by completely new schemes will not be more than 5 or 6 million acres at the present cost on new projects. This coverage will also take anything from 5 to 10 years to complete. We have a habit of wishing away our difficulties and refusing to face hard facts. The country can afford to do so in this matter only at its own peril,