Dr. S.P. Raychaudhuri,
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NEW DELHI.

Dated, the 17th Feb., 1968.

My dear Dr. Swaminathan,

Kindly refer to your D.O. letter No. PA/6605 dated 13.2.68.

As desired, I am sending herewith another copy of the note referred to therein.

With kind personal regards,

Yours sincerely,

(S.P. RAYCHAUDHURI)

Dr. M.S. Swaminathan,
Director,
IARI, New Delhi.

I. Rice: Immediately after the release of rice variety Taichung Native-1 in the farmers field on an experimental scale during the monsoon of 1965, this Institute had clearly published that the variety cannot withstand the onslaught of bacterial blight in the rainy season. This was based on a careful survey and examination of many plots of Taichung Native-1 in Andhra Pradesh. Even earlier, after the Bihar epidemic of the disease, this Institute had emphasised the danger on account of this disease after careful examination of seed and plants from the epidemic area. Despite these warnings, the cultivation of Taichung Native-1 was extended to larger areas in the country in the subsequent years, leading to widespread epidemic of the disease. Although in the winter season the disease in most parts is of limited consequence, cultivation of this variety can lead to accumulation of heavy inoculum, leading to severe epidemics in the rainy season crops.

The rice variety IR-8 is ~~also~~ also highly susceptible to bacterial blight; it is selectively susceptible to another bacterial disease viz., leaf streak as observed in the farmers' fields and in experimental tests at this Institute. From the viewpoint of susceptibility to bacterial diseases, this variety is no better than Taichung Native-1.

The cultivation of the above varieties is bound to lead to build up of inoculum which can present hazards even to local varieties.

The practical solution is to obtain good and desirable sources of resistance and incorporate it in commercial varieties. This programme has been earnestly pursued and the first part viz., selection of good resistance has been accomplished. This has been made available for breeding of commercial resistant types.

Four virus diseases of rice have been observed on the high yielding varieties like Taichung Native-1, Taichung-65 and IR-8 and two of them, namely, leaf yellowing (resembling Tungro) which is a devastating disease and yellow dwarf have been established to be present in all rice growing areas. Leaf yellowing results in unfilled glumes and yellow dwarf is more prevalent on the ratoons. Several grasses are known and have been found to be the hosts of this virus and, therefore, the problem of controlling this disease becomes all the more difficult. Other two viruses of rice, namely, grassy-shoot and Orange leaf are suspected to be present in India and work on these four viruses have been intensified at the I.A.R.I. As an immediate measure, large scale screening tests have been taken up and paddy varieties Pankhari 203 and Intan have been found to be resistant to ~~the~~ leaf yellowing virus. In order to avoid the incidence of the active leaf hopper vectors, systemic insecticide like Fardon is being tested. Seed dressing against vectors has given excellent results in preliminary trials. The work will be intensified in the next season under field conditions. These viruses are not seed borne. However, their manifestation is much more now due to the introduction of high yieling varieties of paddy and the disease is spreading in most of the rice growing areas. Attempt is being made to find out the source of resistance against both bacterial blight and the virus diseases like leaf-yellowing and yellow dwarf to protect the rice crop so that it can resist infection with both these devastating plant pathogens.

II. Wheat: Since the beginning of this year a constant watch by survey teams is being made. News-letters giving overall rust incidence are being issued fortnightly. So far, the position has been quite encouraging and by and large the Mexican

varieties appear to be standing well against rusts. However, black and brown rusts have been reported on Sonora-64 from Coimbatore. As can be seen from the attached sheet (Appendix-1) none of the high yielding varieties are immune or resistant to all the races of 3 rusts. Under ~~the~~ certain condition the chances of epidemics will always be there. The losses due to rust disease can be reasonably reduced by application of zineb (75%) at fortnightly intervals. Lerma rojo and Sonora-64 which at present occupy maximum area are susceptible to loose smut of wheat. This can be effectively kept under limits by proper roguing of the diseased plants and by solar heat treatment of the seed stock in the month of May. Work on control of disease by using systemic fungicides is in progress and has given promising results. S.227 (unselected), S.308 and PV.18 have been found to be tolerant to loose smut. Safed Lerma (S.307) and Sonalika (S.308), Lerma rojo are susceptible to hill bunt disease which can be controlled by proper seed dressing with Mercurial fungicides such as Ceresan. The high yielding Mexican varieties (Sonora-64, Lerma rojo, S.227 and PV.18) are also susceptible to leaf blight of wheat caused by Alternaria triticina, a disease which has gained considerable importance in the recent years. Seed infection has been established to be the potential source in the perpetuation of the disease which can be checked by soaking in water for 4 hours followed by hot water treatment at 52°C for 10 minutes. Spraying the crop with zineb (75%) at the rate of one Kg. in 100 gallons of water per acre has shown to be effective in checking the disease. Screening of varieties is in progress.

A new ~~streak~~ streak mosaic of wheat which is transmitted in nature by four aphid vectors and is transmissible to ginger, orchids and some perennial weeds has recently been reported on Mexican varieties. Some of the high yielding varieties like

Lerma rojo, Sonora.64 including Sharbati Sonora are highly susceptible to it. Very often it results in empty glumes causing heavy losses. Screening of the varieties for source resistant is in progress and so far the varieties Ridley, NP.809 amd E.C. 4647 have been found to be resistant and more varieties are being tested. Another new disease which was not known earlier in this country is a leaf blight caused by Helminthosporium specifierum. In preliminary experiment considerable loss due to this disease have been recorded. Varieties like S.227 (unselected) S.308, Sonora.64 and Lerma rojo are susceptible. The disease can perpetuate in seed as well as soil. Experiment on the control of disease by seed-dressing are in progress. Amongst the nematode and bacterial diseases 'Molya' and 'Tundu' have attracted attention since the high yielding varieties like Sonora.63, Sonora.64, Lerma rojo, PV.18 are susceptible to it while NP.718 and NP.771 are tolerant. As an immediate measure crop rotation of 1 to 2 years with crops like Cumin and carrot will help in reducing the disease in Rajasthan and Haryana region. The Mexican varieties (Sonora.63, Sonora.64, Lerma rojo and S.227) are also susceptible to Earcockle disease which can be controlled by separating the galls by flotation method which is quite easy and does not incur any expenditure.

III. Sorghum: The male sterile parents of the high yielding jowar varieties CSH-1 and 2 are very highly susceptible to sugary disease destroying the seed production completely. The ergot formation which was only recorded as an academic interest in the past occured very severely on these male sterile lines and even though at present they do not contain the alkaloid, it is likely that with continued occurrence of the disease on more favourable hosts the alkaloid content may increase as in the

case of Bajra ergot. The widespread occurrence of head moulds due to fungal pathogens on the new hybrids spoils the quality of grains besides reducing the yield. The zonate leaf blight caused by Gloeocercospora sorghi is a limiting factor in getting a good seeding stand especially in mid and northern region of India. Fungicides are being tested to control these diseases along with the development of resistant varieties.

IV. Bajra: The bajra hybrid-1 and 2 are very highly susceptible to ergot disease which occured in almost all areas wherever these are grown. In fact, in certain fields the disease occured up to 100 percent. Both the parents of the hybrids were found to be highly susceptible. The potential danger of this disease was pointed out by Pathologists at the seminar held at Ludhiana even before the large scale distribution of the variety by the National Seeds Corporation. The alkaloid content of bajra ergot was found to exceed one percent which is three to four times over the normal quantity of alkaloids present in rye ergot and is posing a greater danger to human and cattle life besides reducing yield. With the introduction of the hybrids the incidence of this disease is on the increase especially in humid areas. The rust disease is very severe on high yielding varieties in many places leading to complete drying up of leaves thus reducing the grain yield considerably. Blast disease caused by Piricularia sp. which was not known on bajra in the past has become a serious problem in Northern parts of India on the high yielding varieties. With continued and widespread cultivation of these high yielding varieties, which are highly susceptible to the above diseases, even the local less susceptible ones will become highly susceptible as is evident in the case of ergot of bajra. Intensive

studies on the host resistance, fungicidal control in reducing inoculum potential and also the role of the collateral host are in progress. Campaign to control the ergot disease should be intensified in all areas.

V. Maize: The most widespread new disease is the downy mildew caused by Sclerophthora rayssiae var. zeae. Among the released hybrids, Ganga 3, VL 54 are highly susceptible and to a lesser extent are Ganga safed 2 and Hi-starcj. While the hybrid Ganga 101 has been noted to be moderately resistant in parts of Himachal Pradesh (Dhaula-kuan) in 1967 "Kharif" it had a high downy mildew incidence. The most susceptible parental inbred line is CM 110 (used in hybriad Ganga 3). Resistant inbred lines have been identified. Similarly varieties and composite varieties such as Antigua Gr 2, Antigua 2 D, Caribbean flint composite, Eto Amarillo have some resistance. Among the released composits, Sona is susceptible, Jawahar and kisan appear to be less so. Since germination and infection processes of the pathogen occur at temperatures below 25°C, early planting of maize (June) in Northern half of the country will largely reduce primary outbreaks of the disease. S_1 lines from the released Composites, Sona, kisan and Jawahar have been established. Lines resistant to the new downy mildew and two Helminthosporiums have been selected keeping in view other desirable agronomic characters. These would be combined to constitute new synthetics. Experiments on direct control of the disease with fungicidal sprays were conducted in 1967"kharif". Although none of the fungicides proved quite effective, thiocarbamate types slightly reduced the disease incidence. Further studies are in progress to watch out the life cycle of the pathogen and to determine the conditions which favour the initial outbreak of the disease.

Hybrids Ganga safed 2, Him 123, VL.54, Hi-starch and Ganga 5 are also susceptible to Cephalosporium stalk rot (Black bundle disease). Hybrids Ganga 101, Deccan and Ranjit appear to be resistant. Among composits kisan is moderately susceptible. Continuous surveys during the crop season are made to gather systematic information on all the diseases and the types of maize (inbred lines, hybrids, single rosses material, composits and open pollinated varieties) that they infect. Maize mosaic virus disease has also been studied and among the resistant inbred lines identified so far mention may be made of (Vem 31 x Venz.400. Hybrids Hi-starch, VL.54 Ranjit and Ganga safed 2 have also been found susceptible to a bacterial disease caused by Xanthomonas rubrilineans. An inbred line CM 104 has been found resistant. A new disease caused by Phaeosphaeria maydis was found in Eastern region of India on Amarillo de Cuba variety.

Package practice of seed treatment with organo-mercurials like ceresan for wheat and paddy, thiram for maize and millets should be followed throughout the country compulsorily. The pathogens carried as admixture with the seed such as "ear cockle" of wheat, ergot of bajra and jowar should be removed by flotation method. In order to reduce the inoculum of different pathogens, known fungicidal control measures like spraying with z zineb against Alternaria blight and rusts of wheat, leaf blight of maize, rusts of bajra and sorghum may be followed. On a long term measure, consistent research on the location of resistant genes for various important diseases as is being done in case of ergot of bajra and jowar, Alternaria and Helminthosporium blights, rusts of wheat, mosaic streak of wheat, bacterial blight and virus diseases of paddy, downy mildew, stalk rot and mosaic of maize etc. is being

intensified. The close collaboration of Breeders and Plant Pathologists can yield useful results of great economic value to Indian Agriculture. All the varieties before release by the variety release committee should be tested for resistance to diseases and also seeds distributed by the National Seeds Corporation should be certified for freedom from diseases by competent Plant Pathologists. This will avoid the tragic epidemics which we are facing presently by premature release of many new high yielding varieties. As regards the introduction of germ plasm (seeds) of high yielding varieties, immediate steps should be undertaken to see that no new pathogen or new strains of existing pathogens are introduced by ignoring the proper check up by trained scientists wo can issue phytosanitary certificates.

Dr. M.S. Swaminathan,
DIRECTOR.

D.O.No. PA/
INDIAN AGRICULTURAL RESEARCH INSTITUTE,
New Delhi, September 24, 1968.

Dr. B.P. Pal,
Director-General,
I.C.A.R., Krishi Bhavan,
New Delhi-1:

My dear Dr. Pal:

Thank you for your letter No. 78(31)/68-A.S.I dated September 3, 1968. Since your query relates to a matter which has arisen from an important change in policy made by the ICAR recently, I am giving a detailed analysis of the position.

1. Aims of the National Demonstration Programme

This programme was initiated by the Department of Agriculture in 1965 with the following two major aims:

a) To provide scientists with an opportunity to demonstrate in the fields of farmers the new vistas in yield opened up by the high-yielding varieties and hybrids of cereals and millets and to introduce both farmers and extension workers to the changes in agronomic practices necessary for enabling the new varieties to reveal their full yield potential.

b) To assess the reactions of farmers to the new varieties and to identify the factors which limit yield in farmers' fields.

From 1967, the scope of the programme was enlarged to include the role of multiple cropping in increasing the yield and income from small holdings. The establishment of a feed-back relationship between the farmer and the scientist was an important aim of this programme. The demonstrations had purposely no control plots, since the difference between the farmer's yield and the targetted yield in the demonstration plot was to be of such an order that the farmer would never have conceived as possible before. The striking impact of these demonstrations was largely due to the challenging spirit in which these demonstrations were taken up by research workers, who laid them out with the latest strains and the consequent great difference in yield demonstrated. Until this season, hybrids and varieties were grown in such demonstrations, which might not have been approved formally for release but which were sufficiently promising as to merit assessment by the farmers.

You may recall that in the first meeting held in April,1965, for organising these demonstrations, the representatives of Maharashtra and Rajasthan were very reluctant to agree to the growing of CSH-I jowar and HB-I bajra in the demonstrations in their States on the ground that they had not tested this material properly. However, they were persuaded to agree and the demonstrations organised during kharif 1965 were largely responsible for the dynamic programme of CSH-I production undertaken by the Maharashtra Government subsequently. The outlook of the Rajasthan Government towards Hybrid

Bajra underwent a similar transformation as a result of the National Demonstrations. Similarly, the demonstrations with dwarf wheats not only helped to create enthusiasm for such varieties among farmers and State Governments but also led us to understand the significance of the depth of sowing in relation to germination and population density. The poor germination of some of the seeds obtained from Mexico in villages was later diagnosed as being due to deep sowing. Even scientists who were skeptical about the value and purpose of these demonstrations in the beginning when I suggested this programme, are now unanimous in the view that these demonstrations have played a crucial role in arousing a general awareness of the great production potential of our agriculture. I enclose a copy of a recent letter received from Shri W.T. Butany as an example of the importance now attached by the scientific community to the catalytic role played by this tool in bringing about a radical change in the farmers' attitude to the adoption of scientific farming and to the generation of a hunger for inputs like seeds and fertilizer.

2. National Demonstrations in Rice and the reasons for the inclusion of Dwarf Basmati

You may recall that in the case of rice, we laid out an excellent demonstration with IR-8 during the International Rice Year in 1966 in the village Nangal Thakran of Delhi State. The Secretary to the Department of Agriculture, Shri B. Sivaraman, was the Chief Guest on the Field Day organised in this farmer's field. The farmer gave all the seeds of IR-8 from this demonstration to the National Seeds Corporation. This demonstration created a great enthusiasm for the variety in this area but unfortunately this enthusiasm has proved to be short lived due to the coarse nature of the grains of this variety. After attending the Rice Workers' Meeting held in Hyderabad in April this year, it became clear to me even more than before that duration and quality characters are of the utmost importance in the acceptability of new rice varieties by the farmers. You may recall the comments made by Dr. Dikshit, Rice Breeder of Uttar Pradesh, at the Workshop. It is only in anticipation of the importance which might be attached by the farming community to grain quality that I started in 1965 a programme of crossing Taichung Native I with a Dehra Dun Basmati strain, followed by recurrent back crossing to the Basmati parent, all the time selection being made for dwarfing, photo-insensitivity, early maturity, slow senscence, resistance to the important diseases and fine grain quality. There is no rice breeding section or staff at the Indian Agricultural Research Institute but I initiated this work with the help of a student only because I felt that if we can combine fertilizer-responsiveness with grain quality, India can soon usher in a rice revolution and also become an important rice exporting nation. I had assigned this work to Dr.E.A. Siddiq, who had then joined as a postgraduate student to do Ph.D. work under my guidance. The work made rapid progress due to the co-operation of some State Research Stations, where we could raise 2 additional generations in a year. Some good cultures from this material were entered in the initial evaluation trial last year. The data I have received from Dr. S.V.S. Shastry show that two of these cultures gave over 6 tonnes per hectare in about 110 days. You have also seen these cultures at Hyderabad. They are now in the uniform varietal trial at several locations in North India. Recently, Dr. G.S. Khush of the International Rice Research Institute said on visiting our fields that they do not have at IRRI such beautiful strains combining a desirable plant type with a fine grain type.

When I returned from Hyderabad in April, we were preparing for the All-India meeting to decide upon this year's programme of National Demonstrations. During a visit to the villages in the middle of April, I found a general reluctance among the farmers to grow the rice variety IR-8. In fact, most of them were prepared to give land for a demonstration with NP 130 but not IR-8. This is in spite of the fact that a large number of them have seen our excellent demonstrations with this variety. The reason for the preference for NP 130 over IR-8 was because of the considerable price difference between the grains of these two varieties in the market. Last month, IR-8 grains could be purchased for about Rs. 80/- per quintal, while NP 130 grains would fetch about Rs. 150/- per quintal.

When the Extension Division sent to me a programme of Multiple Cropping Demonstrations involving three crops per year, I felt that we should also lay out a few four-crop per year demonstrations, aiming at a total grain production of about 20 tonnes per hectare per year. This was for the purpose of retaining the path-breaking role of these demonstrations in the matter of yield per unit area per unit time. I strongly felt that we should not allow this programme to degenerate into yet another routine demonstration. I enclose a copy of a letter I then wrote to Dr. K.N. Singh giving my suggestions for initiating a 4-crop demonstration.

The Indian Council of Agricultural Research's letter No. 78(31)/68-A.S.I dated 26.6.68 informing a change in policy with reference to the use of unreleased varieties in National Demonstrations was received on 29.6.68 and I immediately marked it for strict compliance to all the Divisions. I also mentioned this subject in the Heads of Divisions meeting on 3.7.68 - Para 14 of the minutes, copy sent to you, refers. In April, 1968, I had suggested the inclusion of a dwarf Basmati selection in one of the 4-crop per year demonstrations for the following reasons:

a) No other high-yielding rice variety with a suitable maturity period was available. Hence, the suitability of the early dwarf Basmati for use in such rotations could be assessed.

b) Since the dwarf Basmati appeared promising in co-ordinated trials, the data from a National Demonstration could help both the assessment of yield under farmers' conditions and also the opinion of the farmers about the variety. This seemed particularly important, since we do not have a good rice field in the Institute. As in the past, I felt that such data would help us to suggest to the Central Variety Release Committee with confidence that the variety can be safely recommended for release.

When we laid out the National Demonstration with IR-8 in 1966, even IRRI had not officially released the variety and the demonstration at Delhi with this strain was one of the factors which led IRRI to conclude that it should be released without delay. You may note from my letter to Dr. K.N. Singh written before the evolution of the present policy banning the ascertaining of farmers' views on a variety before large scale seed multiplication has been done and the variety officially released, that I had stipulated that the demonstration should be laid out only if the

seeds can be got back and that it should be laid out in poor farmers' fields, who, experience has shown, are honest and value their honour more than money. The Extension Division in their reply stated that only one demonstration with a dwarf basmati strain has already been laid out by Dr. Mathur, Extension Agronomist, and that the new policy will be strictly adhered to henceforth. I, however, asked once again for an assurance from the Head of the Division of Extension that arrangements have been made for getting all the seeds back and such an assurance was given. I enclose copies of the relevant correspondence. To satisfy myself on this point, I also visited this demonstration put out in the field of Shri Mir Singh of Daryapur village. In view of the stringent conditions I had imposed on the choice of farmers, a farmer with very poor means had been selected and unfortunately the demonstration has failed due to the high sodium content in the water of the well of this farmer and the drought conditions in recent weeks. In any case whatever little quantity of seeds may be produced by a few plants in this demonstration will be got back. In addition to this demonstration, we have laid out 5 demonstrations with IR-8. It is, however, clear that the farmers will revert to NP 130 and other five grain varieties completely from next season, unless we can give them a dwarf, fine-grain strain.

3. Need for Review of the Ban on ascertaining farmers' views on new [illegible] varieties

While we shall not lay out any demonstration with any unreleased variety as long as the present ban continues, I would request you to review this decision. In my view, it is scientifically wrong to recommend any new variety to the farmer before it has been tested at least for one season in the fields of a few farmers and their reactions assessed. Some years ago, our State Departments of Agriculture insisted on at least three years data from trials conducted in the fields of cultivators before a variety is approved for release. Now we have gone to the other extreme of a total ban on the assessment of a variety under development in a farmer's field, before large quantities of seeds are multiplied by the National Seeds Corporation and the variety is approved by the Central Variety Release Committee. As the Leader of Indian Plant Breeding, you know only too well that to the breeder a variety is like his own child. While he may hence overlook some of its defects, farmers will have no such sentiments and will rigorously reject varieties which are not acceptable to them on one ground or the other. The experience of the Taichung Native I and Tainan 3 programmes underline the need for ascertaining the views of farmers and consumers on new varieties before large sums of money and effort are spent on the pre-release multiplication of a strain. "Large quantities of seeds and no demand" would be a much more undesirable situation than "Small quantities of seeds and a huge demand". The former condition would undermine the confidence of the farming community in research workers and extension officials. We will in this way dissipate the faith generated at great effort during the last four years among farmers both in scientific farming and scientists.

While we should take all precautions to ensure that no private individual is allowed to exploit research carried out with public funds for undue personal gain, it would not be in

Increase in ~~Wheat~~ Wheat Production: It is common knowledge now that wheat is the only cereal in which we have been able to break the yield dilemma and make some real advances in productivity per unit area. The basic reason for this is ~~has not~~ however not known widely.. In this crop, ~~the~~ the action programme relating to the cultivation of dwarf varieties with suitable doses of fertilizers ~~was~~ erected on sound scientific knowledge. Research data on the performance of different ~~the~~ dwarf varieties of wheat and the changes needed in the agronomic practices ~~such as~~ with reference to the date of sowing, the depth of seeding, the timing of the first and last irrigation, and the time and method of application of fertilizers were gathered during 1963-65

A National Demonstration Programme was organised during 1965 under which scientists directly demonstrated in the fields of farmers the new yield possibilities opened up by the dwarf

& wheats and the changes in cultural practices needed ~~to~~ for such varieties to express their yield potential. This demonstration programme generated an enormous enthusiasm among the farming community for such wheats and to satisfy the hunger for seeds, the Govt. of India imported 18,000 tonnes of seeds of Lerma Rojo and Sonora 64 from Mexico in 1966. At the suggestion of the state chief Ministers Meanwhile, ~~Indian~~ ~~scientists had~~ we speedily developed dwarf strains which combined yield with the desirable quality characters and as a result, we witnessed an unprecedented enthusiasm among wheat farmers in the Punjab, Haryana, Delhi, Rajasthan during 1967-68 and western Uttar Pradesh for the seeds of the new varieties.

Thus, in contrast to the rice programme where administrative action preceded the development of scientific know-how, the Wheat programme ~~is an excellent example of what Indian agriculture can achieve, provided an action development programme is~~ was erected on the foundation of scientific data and results extension education. The contrasting ~~experience~~ should show us the path to be chosen in the future.

~~Future of Wheat Production:~~

~~Problems in in~~ Problems in ~~obtain~~ getting high yields from the dwarf varieties.

The Taiwan and Phillipine rice varieties which, due to their non-lodging habit, have the ability to respond ~~to~~ well to good conditions of soil fertility, ~~have~~ are ~~unfor~~ ~~(un)~~ unfortunately highly susceptible to virus and bacterial diseases. ~~In our~~ As a consequence, virus diseases are growing in importance ~~from~~ for the first time in our long history of rice culture. In addition, these varieties compare poorly with our earlier strains in cooking quality and consumer acceptance. The cooking quality is particularly alien to Indian taste in Japonica varieties like Taiwan 3 and Taichung 65 which were recommended for cultivation in Kerala and Mysore respectively. Also, agronomic studies conducted subsequent to the initiation of the H.Y.V. programme have shown that

date of planting, cultural practices such as depth of transplanting, ~~spacing~~, age of seedlings at the time of transplanting, spacing, time and method of fertilizer application, type of water management adopted and time of harvesting, may all influence yield considerably. Thus, depending upon the level of management the response to fertilizer application will fluctuate.

Knowledge concerning the numerous small but crucial changes which need to be introduced in rice agronomy was not available at the time the H.Y.V. programme was initiated in rice and even today such knowledge is ~~neither~~ not

widespread even among extension workers.

In many parts of India, rice yields are ~~towards~~ low more because of excess of water rather than ~~because of~~ due to a lack of it. Although the rice plant has a tissue which transfers oxygen into the soil to offset the reductive condition prevailing in the soil, root rot occurs when there is continuous submergence. Hence, the optimum submergence - drainage cycle needs to be ~~investigated~~ standardised for each area. In most areas, short periods of draining of soil during the tillering stage would be very ~~very~~ beneficial. As in the case of irrigation, much work needs to be done in understanding the need for nitrogen in relation to the total carbohydrates synthesised.

Blanket recommendations for an entire country or even a whole State ~~is~~ are ~~both~~ wrong both from the point of view of economics and science. Unless the seedlings contain both nitrogen and carbohydrates in a proper proportion, they may suffer from sterility and reduced response to fertilizer application. Hence, to increase rice yields substantially we need urgently new varieties combining yield and quality and the standardisation and spread of a new agronomy suited for these varieties

As I mentioned earlier, a series of high yielding cum high quality varieties of wheat and rice are now in the breeders' assembly line. This is fortunate since to sustain a dynamic agricultural programme, both varietal diversity and a rapid replacement of varieties are vital. In this respect, agricultural planning differs radically from industrial planning. Any programme of agricultural advance designed to bring about, should ~~have~~ provide for sufficient flexibility with regard to the actual tools and strategy employed to bring about a desired end-result at a given time. So far, this approach has not been in evidence with the result that ~~both success and failure has resulted in different areas depending upon the tool employed.~~ confusing and conflicting patterns of response have been recorded with regard to the success of the H.Y.V. programme. For example, Kerala is reported to

have shown the ~~highest~~ lowest degree of ~~resistance~~ acceptance ~~to with the regard to the~~ of high yielding varieties by farmers, while Punjab occupies ~~the~~ the top position at the other end of the scale. Ironically, the highest percentage of literacy occurs in Kerala and literacy has often been cited as the first requisite for the adoption of new ideas. The reason for this enigma is the wrong choice of the rice variety used in the programme, namely Taichung 3, which shows great stickiness (become sticky on cooking). In contrast, the wheat and bajra varieties recommended in the Punjab grain which have an acceptable quality.

The future of high yielding varieties in our country will be bright and they can become important instruments of food self-sufficiency, economic progress, and rural prosperity provided the requisite scientific and training bases are first created, and which are

capable of anticipating and finding prior solutions to the numerous new problems which will arise from the spread of such strains, are first created. ~~It is to~~ I hope that this will be done, since there is no other way open to get more food from our land, either in the irrigated or unirrigated areas.

TABLE I

YIELD STABILITY IN SORGHUM [Y]

MATERIAL AND CHARACTER	1963	1964	1965	1966	1967
Mean Yield (Q/ha)					
a) CSH-1	23.37	26.76	30.40	21.66	32.72
b) Local	13.02	18.66	19.17	12.93	20.46
Regression Coefficient					
a) CSH-1	1.15	0.95	0.96	1.17	0.75
b) Local	0.73	1.01	0.69	0.75	1.01
Deviation from Regression					
a) CSH-1	14.64	15.63	52.55	19.05	46.45
b) Local	72.64	16.97	25.17	57.35	36.10

Y. Data collected by Drs N. Ganga Prasad Rao and G. Harnarayana of IARI

Wheat seeds available for distribution at A.R.S., Karnal during 1968.

S.No.	Name of Seed	Quantity produced in qtls.	Expected Screen in qtls.	Estimated qty of seed after grading in qtls.	Supplied under pre-released to N.S.C.	Seed reserved for Sowing at A.R.S.,	Estimated qty. of seed for distribution.
1	2	3	4	5	6	7	8
1.	Wheat Kalyan Sona.						
	SC1	41.81	11.87	30.0	--	1.00	29.00
	S2	34.70	8.70	26.0	--	1.00	25.00
	P106	13.43	3.43	10.0	--	--	10.00
	P15/N1	18.86	4.86	14.0	--	--	14.00
	D9/NR	27.41	7.41	20.0	5.0	1.0	14.00
	P104/NR	14.79	3.79	11.0	5.0	1.0	5.00
	P8/N1	11.15	2.15	9.0	5.0	1.0	3.00
	P69/N1	6.97	0.97	6.0	--	--	6.00
	P129/NR	7.90	1.90	6.0	--	--	6.00
	P54	23.75	5.75	18.0	--	--	18.00
	D144/NR	22.53	4.53	18.0	--	--	18.00
	D135	17.40	4.40	13.0	5.0	1.0	7.00
	D15	13.17	3.17	10.0	5.0	2.0	3.00
	D106	42.66	12.00	30.66	--	--	30.66
	P3	31.66	7.66	24.0	--	2.0	22.00
	P46	21.44	4.44	17.0	--	--	17.00
	P45	14.65	3.65	11.0	--	--	11.00
	P37	34.21	8.21	26.0	--	--	26.00
	P51	6.58	1.58	5.0	--	--	5.00
	Total:-	405.07	100.41	304.66	25.00	10.00	269.66
2.	H.D.1593	37.31	7.31	30.0	20.00	2.00	8.00
3.	H.D.1592	3.58	0.58	3.0	--	2.00	1.00
4.	S-227	22.66	5.66	17.0	--	--	17.0(S)
5.	Sonali Ka						
	H.D.(M)1553	58.34	14.34	44.0	50.00	5.00	94.00
	H.D.(M)1555	143.91	33.91	110.0		5.00	
	Sonalika(1553)	34.25	8.25	26.0	--	--	26.00
6.	S-308	65.23	15.23	50.0	--	2.00	48.00

Contd.....2.

1	2	3	4	5	6	7	8
7.	Chhoti Lerma H.D.(M) 1691	45.54	10.54	35.0	25.0	2.00	8.00
	H.D. 4875	13.16	3.16	10.0	--	2.00	8.00
	S-331	103.44	25.44	78.0	--	2.00	76.00
8.	Sharbati Sonora	107.14	27.14	80.0	--	3.00	77.00
9.	Sonora 64	42.94	10.94	32.0	--	--	32.00
10.	Safed Lerma	96.13	24.13	72.0	--	3.00	69.00
11.	S-307	23.08	6.08	17.0	--	--	17.00
12.	S-305	36.45	9.45	27.0	--	1.00	26.00
17.	Lerma Rajo	33.43	8.43	25.0	--	--	25.00
18.	H.D.236-1625	18.65	4.65	14.0	--	--	14.00
19.	Pamjamo 62A.	11.90	2.90	9.0	--	--	9.00
20.	Norteno 67	11.10	2.10	9.0	5.0	2.00	2.00
21.	N.P.718	2.48	0.48	2.0	--	0.40	1.60
22.	N.P.824	2.62	0.62	2.0	--	0.40	1.60
23.	N.P.830	3.30	0.30	3.0	--	0.40	2.60
24.	N.P.860	3.70	0.70	3.0	--	0.40	2.60
25.	N.P.891	11.50	2.50	9.0	--	0.40	8.60
26.	N.p.876	3.00	--	3.0	--	0.40	2.60
27.	N.P.798	5.00	1.00	4.0	--	--	4.00
28.	N.P.846	16.75	3.75	13.0	--	0.40	12.60
29.	N.P.890	2.30	0.30	2.0	--	0.40	1.60
30.	All India Trial material and New Hybrids and other Delhi trials material	181.27	--	181.27	--	--	Still under Tests.
	Total:-	1545.23	330.30	1214.93	125.00	44.20	854.46

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ASSISTANT AGRONOMIST I/c
A.R.S. Karnal (Haryana)

International Symposium on "Present State in Mutation Breeding" Abstract of paper

Use of Induced Mutations for the improvement of Polyploid Plants

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Indian Agricultural Research Institute
New Delhi

1. Types of Polyploids and their Characteristics

Passage (1)

2. Polyploidy as a means of evolution through macro- or Systematic mutations

Passage (2) from page 5.

(3) Polyploidy in relation to induced mutations. From the foregoing it would be obvious that ~~generalised statement~~ no generalisations can be made concerning the possible response of polyploids to treatments with mutagens. The ~~response~~ procedures for handling populations treated with mutagens ~~procedures~~ have to be modified

to suit the needs of the precise genetic architecture of the polyploid. In ~~polyploids like~~ autopolyploids the screening for mutants will have to be carried on for several generations. Most polyploids have the advantage that a wider range of mutations can be induced in them without causing a high degree of lethality. Experiments in barley (2n = 4x = 28) with ~~autotetraploid~~ ~~with chemical mutagens like~~ Ethyl methane sulphonate treatments have shown that chlorophyll mutations can be recovered even in the ~~induced~~ M_2 generation. This would suggest that unlike radiations, chemical mutagens may cause functional alterations in all the loci governing a specific trait. They therefore offer great promise in overcoming the masking effect on the phenotypic expression of mutations caused by gene duplication in polyploids. Thus, both at the level of induction and of recovery, polyploids offer excellent material for mutation breeding ~~induction of mutations~~.

(4) Induced Mutations and Crop improvement:

The results already obtained in polyploids like Triticum aestivum, Avena sativa, Gossypium hirsutum, Gossypium barbadense, Nicotiana tabacum, Arachis hypogaea, and Saccharum officinarum clearly suggest that mutation breeding would be of great value in

(a) rectifying specific defects in otherwise superior and well-adapted genotypes

(b) creating new characteristics,

(c) enlarging the variability for polygenically conditioned characters.

(d) reconstructing the species using superior initial genotypes and (e) creating scope for introducing altogether new parameters in selection such as productivity per day, fertilizer-responsiveness and altered amino acid balance.

~~In the~~ With the ~~increasing~~ growing interest in the genetic destruction of yield ceilings, ~~mutational manipulation of the tools~~

With the ~~changing~~ enlarging canvas of plant breeding, the tools of ~~mutational~~ manipulation of genes and chromosomes will prove to be invaluable in research ~~relating~~ to the genetic destruction of ceilings to yield.