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Helping farmers adapt to climate change : the NEFORD way

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Abstract

Significant increases in food production in the 20th century have contributed to the improvement of many farmers' livelihood and their economic growth. However, the gains have come with disproportionate environmental, cultural, health and social costs. The agriculture in the 21st century will have to address crucial challenges including climate change, by maintaining and enhancing environmental & cultural services and safeguarding nutritional quality, diversity of food and farming systems. Often the problems in agriculture are not solely caused by a lack or failure of science & technology, but instead derive from social, economic or legal framework. It is therefore critical to define first, what problems are best solved by changing social, economic or legal frameworks and second, those which are best solved by using technology. Further, the green revolution era model of transfer of technology is no more valid, particularly, when it comes to complex issues such as natural resource and climate change. Instead, innovative institutional arrangements are essential to successful design and adoption of ecologically and socially suitable agricultural systems. The roles of NGOs should be seen in this context. The advantage of NGOs lies in their independence status, freedom of raising voice of the poor and involvement at the grass-root level. Nand Educational Foundation for Rural Development (NEFORD) is one such NGO committed to transforming quality of live for the rural poor and under-privileged. It is dedicated to achieve sustainable economic development and preserve environment with the focus on marginal communities. NEFORD is leading an initiative called PARIS (Poverty Alleviation through Rice Innovation Systems) to improve food security (increase yields and reduce input cost), enhance flexibility in response to monsoon and climate change and maintain profitability in the market economy. PARIS aims to build "Partnership for Rice Innovation Platform" and "Communication Systems" to improve information flow to farmers and feedback and facilitate communication through out the information supply chain. The project uses ICT to improve access to information on market, cropping choices, weather forecasts and technology options, for which an "Information Hub" has been developed via the internet and village computer centres, to facilitate information flow between farmers and project partners. The program is about taking "Research Into Use" (RIU). We know a lot about the potential uses of different technologies, but what we don't know is where it is "fit for purpose". To understand this, we are trying to bring together (a) knowledge of how a technology works, (b) appreciation of different agro-ecological conditions, in which it might be the best applied and (c) knowledge of socio-economic domain, in which it could be used. Matching the bio-physical and socio-economic characterizations with the technology profiles (options) enables us to test the usefulness of intervention. The paper highlights the concept of Rice Innovation Systems and describes the functional mechanism and provides examples from the fields on technologies for adaptation to climate change, the nature of trainings to improve farmers' skills and knowledge and innovative approaches for accelerating the pace of technology adoption to reach out larger number of people in a shortest possible time.

Key words: Field demonstration, technology assessment

Introduction

The climate change is real and it is happening. Its effects are being felt in terms of rising temperature, increased or decreased rainfalls, incidence of pests and disease, and even rising sea level, etc. The frequency of extreme weather conditions like floods, droughts and cold & hot waves is likely to increase. Disastrous impacts of climatic variation are being forecasted [1, 2]. It is also a fact that despite all the technological advances like improved varieties, fertilizer, irrigation systems, biotechnology and genetic engineering, weather is the most important determining factor for agricultural productivity. No wonder, all round concerns are being raised regarding creating awareness and developing strategies for mitigation and adaptation to climate change. NGOs and civil societies are no exception. In fact, many of them are today in the forefront of this campaign. It is heartening that the roles of NGOs are well recognized under the UN Agenda 21, Chapter 27, which also

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describes the possible ways of the NGOs involvement in adaptation to climate change.

NGOs have an edge due to their autonomy, involvement at grass-root level and ability to express the human voice and perspective to an issue and can thus represent a community pulse. NGOs may play role both in vertical up-scaling and horizontal out-scaling. The vertical up-scaling includes activities such as influencing policies and research agendas and in identifying where linkages between different sectoral activities need to be strengthened. The horizontal out-scaling activities include promoting and advertizing adaptation strategies to stakeholders as well as testing and promoting baskets of options in collaboration with farmers and other stakeholders.

NEFORD (Nand Educational Foundation for Rural Development) is an NGO engaged in similar activities. This paper briefly describes the way NEFORD is dealing with the changing climate.

NEFORD- the philosophy and approach :

NEFORD is a not-for profit organization committed to transforming quality of life of the rural poor and under-privileged. Since its inception in 2003, NEFORD is dedicated to achieving sustainable economic development and preserving environment with focus on the marginal communities [3]. Its strategy is based on the understanding that eradication of poverty and sustainable economic growth can be achieved only if the poor people themselves participate in activities aimed at improving the circumstances they live in.

The centrality of NEFORD's programs is *"poverty alleviation through extension innovation systems".* We believe that securing future harvests for poorer farmers requires (i) a suite of technological options that improve food security by increasing yields and reducing cost of cultivation, enhance flexibility in response to climate change and maintain profitability, and (ii) a transition from labor-intensive to more knowledge–intensive agriculture. Our programs aim at *'Taking Research into Use'*. Our perception is that although we know a lot about different technologies, but what we don't know is where it is *"fit for purpose".* For this, we need to bring together (a) the knowledge of how a technology like direct seeding of rice (DSR) works, (b) appreciation of the different agro-ecological conditions in which the technology might be applied and the knowledge of the socio-economic domain in which it could be a better fit. Matching biophysical and socio-economic characteristics with the technology profiles enables us to test the usefulness of the particular intervention [4].

In the following few paragraphs, some of NEFORD's activities initiated to achieve above objectives are briefly discussed.

Introducing stress-tolerant rice varieties

NEFORD is a partner in the Bill & Melinda Gates Foundation supported Stress Tolerant Rice for Asia & South Africa (STRASA) Project led by IRRI. A few of the varieties that we are currently testing and promoting include Swarna Sub1 – a submergent tolerant version of the farmers' most preferred rice variety Swarna, Sahbhagi dhan - a drought resistant rice variety and some salt-tolerant varieties released from CSSRI, Karnal. All these varieties have proven their worth in on-farm trials and are becoming popular among the eastern Indian farmers [4]. For example, as evident from Table 1& Fig. 1, Swarna Sub1 not only had higher level of submergence, but also yielded significantly more than the Swarna. On an average, it gave 1.5t/ha more yield than the parental variety Swarna in large scale trials conducted by NEFORD during *Kharif* 2009 when the crop got submerged from 10 to 15 days, often more than once [5].

Table 1. Swarna Sub 1 passes the test

Varieties	Survival (%)	Yield (t/ha)*
Swarna	36.17	2.28
Swarna Sub1	62.5	3.63

Revival of indigenous scented rice

The varietal diversity has fast eroded during Green

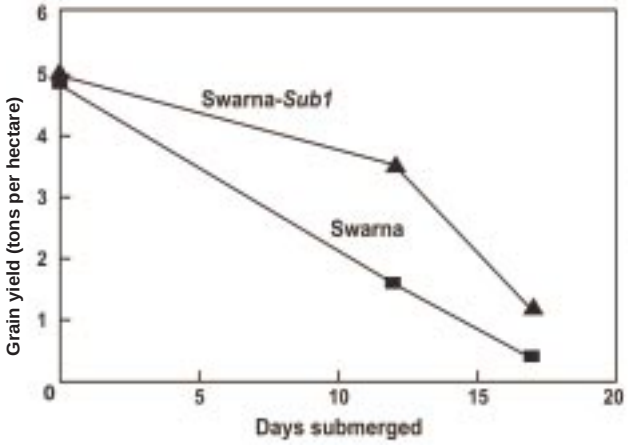

Fig. 1. The yields of Swarna Sub1 & Swarna under varying duration of submergence

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Revolution era when more emphasis was given towards breeding high yielding varieties. The changes in climatic factors have also adversely affected such germplasm which were not on the priority list of the breeders. The indigenous scented rices are one of the most affected germplasm [6]. In Eastern UP alone, there were more than 40 well known scented rice land races, of which not more than 3 or 4 could be traced today, on the farmers' fields.

Kalanamak was one of such high valued materials which was at the verge of extinction, when a group of scientists from GBPUAT, NDUAT and NEFORD launched a program on revival of indigenous scented rices in 1998-1999. This led to selection of two Kalanamak lines – K3131 & K3119 which have now been released by the Govt. of U.P. and is being promoted by NEFORD. These selections combined with improved agronomic practices (e.g. Kalam transplanting) have given more than twice the yield of traditional Kalanamak (Fig. 2). These improved practices also enabled the farmers to earn much higher returns than from the traditional practice and variety (Fig. 3).

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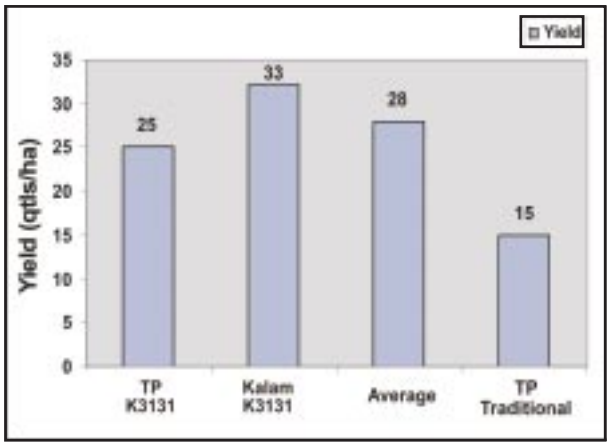

Fig. 2. Crop Establishment Method and Cultivar Types

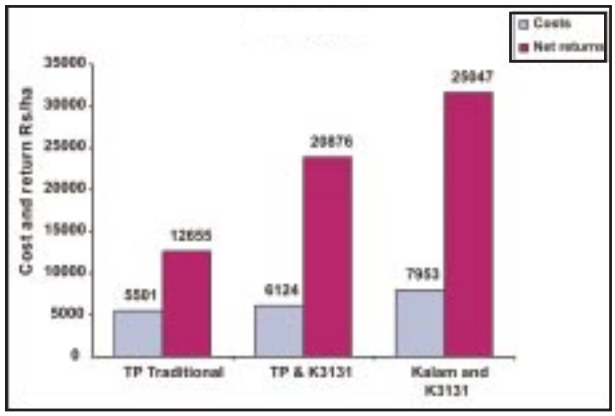

Fig. 3. Comparative cost and return by CE methods and variety type

Being a long duration variety, Kalanamak is harvested late, generally by late December and hence the farmers of traditional Kalanamak areas often leave their fields fallow or grow normal duration wheat varieties with hardly 1 to 1.5t/ha yield. NEFORD introduced and is promoting a combination of Kalanamak and short-duration varieties of wheat like Halna and NDW1014. These varieties mature in about 100 days and even if sown up to middle of January, they complete their life cycle and produce normal yields of about 4t/ha yield. As evident from Table 2, a combination of K-3131 and Halna gave a return of more than Rs. 37,000/- per hectare compared to only about Rs. 12,000/- from K3131 followed by HD2285.

Table 2. Economics of a cropping system: Long duration Kalanamak rice – Short duration wheat variety

Kharif + *rabi*	KN 3131 + Halna*	KN 3131 + HD 2285**
Cost	30884	30614
Output	68000	42545
Returns	37116	11931
BC ratio	2.20	1.39

*A short duration wheat; **A long duration wheat.

Direct seeding of rice (DSR)

The rice farmers today are confronting with the twin problems of shortage of labour and water. NEFORD is promoting the technology of Direct Seeding of Rice and Zero-till sowing of wheat. The data in Table 3, clearly shows that there is no penalty to yield in case of direct sown rice, when compared to transplanting, whereas the cost of cultivation in case of former is much reduced, besides reduced dependence on labour and water. Both shortages of labour and water have emerged as the greatest hurdle in rice cultivation and the farmers, in some places, are abandoning rice cultivation. DSR seems to be the best available option [7].

Table 3. A comparison of yields under DSR and transplanting (*kharif* 2008)

District	No. of farmers	Area	Average yields (q/ha)	
			DSR	TP
Mau	10	5.0	30.56	31.30
Siddharth Nagar	10	5.0	39.74	38.92
Gorakhpur	10	5.0	35.88	36.64
Overall Average			35.41	35.62

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Moisture availability and crop planning

Since NEFORD works in eastern India where weather uncertainty is a key factor, monitoring of moisture availability is a major activity. The district-wise data on long-term rainfall patterns and moisture availability are being studied for appropriate crop planning. As evident from Table 4, the humid period (i.e. the period when rainfall exceeds PET and there is surplus of water) in district Mau (U.P.) is of 125 days and the Moist II period, i.e. the period when rainfall is lower, but greater than half of PET, is of 19 days. Based on such information, the Moisture Availability Index (MOI) at different growth stages has been worked out (Table 5). Accordingly, medium to short duration varieties seem to complete their life cycle without any stress and loss of yields, as the required MAI matches well with the available MAI. However, this is not the case with long duration varieties, and hence are likely to face stress at reproductive as well as maturity stage. Under this situation, we are encouraging farmers to advance planting and better use direct seedling which advances maturity by about 10-12 days.

Table 4. Moisture availability and crop planning in the rainfed areas of eastern India–Mau

Moist I	11 June – 25 June	14 days
Humid	26 June – 26 October	125 days
Moist II	27 October – 14 November	19 days

Moist I = The period when rainfall is less than PET but greater than half PET.
Humid = The period when rainfall exceed PET and there is surplus of water.
Moist II = The period when rainfall is lower than PET but greater than half PET.

Innovation in technology dissemination

Some of the necessary conditions for technology adoption include value addition by combining appropriate component technologies (e.g. DSR + New Seeds), farm-level seed production and seed health management and ensuring inputs availability and product disposal. NEFORD tries to fulfill all these conditions and thereby help increase the interest of the farmers in the new interventions. Secondly, knowledge sharing and dissemination to large number of stakeholders, especially farmers, in a shortest possible time, by adopting novel approaches such as *"Seeing is believing"* trips, *"Walk through the farmers' fields"* and *"Learning tours"*, *"Farmers to farmers dialogue"*, *"Kisaan Mela"* and *"District Agriculture Development Forum"* etc. Some of these approaches have been well documented and seem to work effectively [4]. The success stories are also quite useful in disseminating knowledge and creating interest among the stakeholders. We published several stories based on farmers' experiences of new

Table 5. Moisture availability index (MAI) at different growth stages of medium and long duration rice varieties

Crop stage	Medium duration		Long duration	
	Required MAI	Available MAI	Required MAI	Available MAI
Seedling	0.75	0.99	0.75	0.99
Vegetative	1.00	1.00	1.00	0.99
Reproductive	1.00	0.95	1.00	0.87
Maturity	0.75	0.68	0.75	0.62

The Indian Express — APRIL 10, 2009

FROM the FIELDS — 15

A new gold standard for flood-resistant rice cultivation

Swarna Sub-1, developed by Indian Rice Research Institute, is expected to ensure extra 2 mn tonnes of rice from eastern UP alone

Fig. 4.

interventions that included *"A great experiment succeeds"* (a Swarna Sub1 story), *"I am pleased, I planted it"* (a Kalanamak story), *"A scientist's dream turning into a mass movement"* and so on.

A few of these stories are already published and have received wide attention [8]. For instance, after reading the Swarna Sub1 story - *a great experiment succeeds*, the Deputy Director General, IRRI commented that *"This is much more fun to read than the usual project report and it does not need any statistics to back up".* On the story – *a scientist's dream turning into a mass movement*, Dr. Mruthyunjaya, the National Director (NAIP) wrote, *"The moral and message of the story is 'Clone Mazids' for science to make a difference to society. Well done Dr. Mazid and well reported Dr. Singh!".* This story was based on a Bangladesh (Rungpur) visit where Dr. Mazid has successfully demonstrated and spread direct seeding of rice.

Using the power of media is the most effective and the fastest way of spreading knowledge. Each and every activity undertaken by NEFORD is well publicized through press & media to reach large number of people. It is worth while to report here as how a news – *a gold standard for flood-resistant rice cultivation* – published in *The Indian Express* (April 10, 2009), (Fig. 4), created a stirr in the Dept. of Agriculture, Govt. of U.P. and led to sanctioning of two projects worth Rs. 1.5 crores.

Influencing policy and research agenda is another area wherein NEFORD has been quite active. The NEFORD's Director, Dr. R.K. Singh, being the Chairman of the RAC, CRRI, Cuttack and QRT, DRR, Hyderabad played a significant role in bringing in the issue of resource conservation and direct seedling of rice in the forefront of their research agenda.

Responding to immediate disasters

The year 2009 was an unusual year. The rains came much later than the normal years. Therefore, NEFORD's awareness activities concentrated more on dealing with and preparing for adaptation to drought effects. In view of this, the theme of this year's Kisaan mela was chosen as *"New seeds for future prosperity"* and *"Making up the kharif deficit".* The other activities undertaken in this regard by NEFORD were as follows :

- A press conference on *"Preparing for mitigating drought effects on kharif production"* organized on 22nd July, 2009, in which the farmers were given the tips to minimize losses arising due to this emergent situation.
- *"A walk through the rice fields"* with the farmers organized to discuss the problems in the field and provide solutions right there.
- The District Agricultural Development Forum – a wing of NEFORD, organized a workshop on *"Saving rice crop from the failing monsoon".*
- *"An advisory on mitigating early drought and monsoon arrival"* was well publicized and the printed copies distributed to thousands of farmers, beside publicizing through print media and TV.

Reaching out people

During 2008-09, NEFORD could reach out as many as more than 12 thousand stakeholders through various means and activities as described above (Table 6). This number does not include the people who got messages through newspapers, TV and by reading our success stories; obviously, if included the number will increase many folds [9].

Table 6. Number of Farmers Reached During 2008-09

Activities	No. of direct / indirect beneficiaries
(a) Seeing is Believing	175
(b) Farmers to Farmers Dialogue	95
(c) A Walk Through The Rice Fields	235
(d) DSR Technology & Farmer's School	215
(e) DADF	26
(f) Demonstrations	
– DSR	265
– New Varieties	526
(g) Trainings	972
(h) Traveling Workshop	105
(i) Kisaan Mela	10,000
Total	12,614

Conclusion

The rural communities need to adapt to everyday changes in patterns of rainfalls, temperature, crops and live-stock pests and diseases and also deal with the disasters when they occur. Therefore, while developing any strategies or formulating policies in respect of adaptation and mitigation to climate change, the interest of the people at grass-root level must be kept in the forefront. In this context, the role of NGOs like NEFORD becomes quite important. Secondly while developing

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technologies suiting to the predictable changes in climatic factors, is important, innovations in methods for transfer of technology are rather more important. Reaching out to a large number of people (stakeholders) in a shortest possible time, should be the fore most goals of any organizations involved in the process of technology dissemination.

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