

Seeds of Choice for Sustainable Agriculture

- J. Venkateswarlu *

Introduction

It gives me great pleasure to be with you, my esteemed colleagues, to share some of my thoughts on seeds. I am particularly grateful to Dr. Y.Yogeswara Rao, President, Seedmen Association who picked up a soil scientist to address such a distinguished gathering interested in seed. I would like to choose the above topic for the day.

There are several stakeholders in the seed. They include the farmers, the researchers, the producers, the public and private seed extension service providers.

To me seed is the most critical input in any production system – crops, horticulture, fodder, forestry, medicinal and aromatic plants. Seeds include traditional seeds, seedlings, cuttings, slips grafts, tissue cultured plants, etc.

Further SEED implies,

Sustainable,
Ecological,
Economic, and
Development

of the farmer.

Improved seed *per se* contributes upto 40 percent increase in yield of crops while fertilizer enhances the yield by 50 percent. Together the yield increases would be of the order of 95 percent. But with improved management the yields would further improve to 135 percent. This synergy is very important as we would be seeing later in this presentation. While we are aware of the untapped genetic potential, we seem to be less aware of the untapped power of agronomic improvement in crop yields. Recently Evans of CSIRO, Australia quotes the example of a six fold increase in the yield of potato from 1920 to the present time. This, he says, is due to improved agronomic practices without any measurable increase in genetic yield potential.

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Historical perspective

- In ancient agriculture, preservation of seed was primarily the job of the individuals. They were preserving well-ripened seeds dried in the heat of the sun on the threshing ground. Alternately the kings preserved the seed and distributed in due time.

The individual farmers were preserving the seed in various pots, in heaps of husk, as also in bowls. Taking care of good seeds religiously was conducive to the benefit of the farmer, said the great sages.

Uniform seeds produce excellent results. Hence every effort need be made to procure uniform seed. The origin of plentiful yield is the seed.

- The Royal Commission on Agriculture called for introducing improved varieties of crops, especially in regard to millets, pulses and oilseeds. But the Commission cautioned that work on exotic should, in no circumstances, take precedence of work on crops already being grown. The Commission further stated that no new variety should be put out unless it has been thoroughly well established that it possesses marked advantages over those already grown. It is interesting to note the suggestion that improved varieties should be thoroughly tested in the condition under which the farmers would grow them.

The Commission asked for considering the world markets in framing policies in regard to plant breeding. Cooperatives offer best prospects in seed distribution. Use might also be made of private seed agents, the Commission said. It concluded saying that improved varieties of crop need liberal manure treatment for their fullest development.

- The National Commission on Agriculture (NCA) viewed coarse cereals, now called nutritious cereals, would remain as important food crops in the country, as they are drought tolerant.

The NCA felt that the area under wheat and rice should decline. The productivity of various crops also has been projected. Some examples are as follows

Crop	Yield of crops (tonnes / ha)		
	1975	2000 (Target)	Actual (2000-01)
Rice	1.11	3.04	1.91
Wheat	1.30	3.64	2.74
Maize	1.05	2.65	1.84
Sorghum	0.49	1.20	0.77
Pearlmillet	0.50	1.25	0.72
Pigeonpea	0.71	1.50	0.62
Chickpea	0.64	1.50	0.72
Groundnut	0.78	1.50	0.92
Mustard	0.50	1.00	0.94
Cotton	0.12	0.46	0.19

In retrospect, it is clear that seed had been the prime agent in improving the yield of crops. Emphasis is on introducing exotic varieties with caution and not ignoring the ongoing R&D on crop varieties. Improved varieties need better / increased use of nutrients for their full expression. There was great emphasis on nutritious cereals, pulses and oilseeds. Vertical growth in yield of crops was suggested.

However with a great hurry, the green revolution (GR) was adopted, largely limiting to wheat, rice and to some extent maize, sorghum and pearlmillet. In spite of GR, the projected yields of NCA have not been achieved (*vide supra*). On the other hand, the GR led to loss in biodiversity, increasing costs of production with time. The divide between the better endowed and less endowed increased. GR became unsustainable with particular reference to soil health and consequently of human health. Rice, in particular, supplanted the nutritious cereals thanks to the PDS. The medical bills in rural households bounced several fold.

Now and the Future

With increasing GDP, the food habits also are fast changing. The economists tell us the annual growth rate in demand for fine cereals (rice, wheat) would be of the order of 2.0%, while that of nutritious cereals would be less than 1.0%. There would be increased demand for pulses, vegetable oils, milk, eggs, meat and fish. This is besides a greater demand for fruits and vegetables. All these commodities may have a 4.0 to 6.0 percent annual growth rate in the years to come.

Thus all of us have to think and plan for the anticipated change. There is a great need to diversify. In fact with globalization, Borlaugh already said our country has to move more and more to diversification from rice and wheat, more so from wheat.

That we are falling short of NCA's projections in yield of crops is to be kept in mind. Till a new genetically engineered improvement sets in, we have to take to agronomic improvements in crop production. Still seed would remain the prime agent. The Seedmen Association is acutely conscious of the fact that the seed distributed in the state even in 2003-04 is only 15.48 lakh quintals working out to 29.05 % of the total requirement. There is lot more space for many of us to contribute to fill this huge gap.

The Royal Commission on Agriculture sought the private sector to contribute in the seed sector. This is besides the cooperative institutions.

As an analogy, there is limited public funded Agricultural Extension, as on time. In one estimate, MANAGE pointed out that the presently available governmental extension personnel can at best provide services to a farmer for about 25-30 minutes / year. An abysmally poor status. To bridge this gap, the Private Extension Service Providers, at least one Master Trainer (A good farmer) per habitation is suggested.

Such an improvement in extension is needed for improving the management of the crops. In fact I would venture to suggest that the Seedman job does not stop at selling the seed to the farmer. In fact, his job starts then. Let me quote a few instances.

Way back in 1967, in North Carolina (USA), I found that a Private Bank was giving loans to the farmers. The officer from the Bank was then providing all the technical help / advice needed by the farmer from time to time (seed to seed). Credibility of the Bank and improved relations between the Bank and the Farmer were assured.

Similarly Rural Development Officers of the RRBs and the Public Sector Banks are to provide such an advice. Instead, they have also been brought into the mainstream of administration in course of time.

In South Korea, the farmer with a problem is to plant a red flag in his field. The related extension officer would rush to the farmer within 48 hours to provide the needed spot guidance, as was told by Sri Ramakanth Reddy, the then Commissioner of Agriculture.

That such, spot guidance would improve the yields dramatically was amply proved by the Dryland Research Project in their large-scale crop demonstration on sorghum in 65

villages of west Hyderabad (now Rangareddy) district. It was during that period (1973-74) that the district collector (Dr. Y.V. Reddy, now Governor, RBI) was convinced that the brown rainfed areas also could become green and produce excellent crops, if proper and timely supply of inputs and spot guidance are provided to the farmer.

Another example I like to quote in the Operational Research Project in increasing Rice Production of the Coordinated Project on Rice Research. It was being done in several parts of the state. The case in point is from Mahaboobnagar of Warangal district. The farmers were happy with all the inputs (seed, fertilizers and pesticides) given as doles to increase the yield of rice crop. However, as pointed out by Sri J. Raghotham Reddy, former Vice-chancellor of the State Agricultural University, the farmers were asking the scientists of the Rice Project on the management of crops other than rice. No answers were coming forth from them. The farmers were disappointed in spite of the doles given for rice production.

With these few episodes I like to place before you that the farmer is a composite person with interest not just one crop or one component in a crop production. He likes to have critical technical inputs in relation to various enterprises he likes to venture. So the Seedman, Banker, Researcher and Extension Service Provider must be farmer-friendly and be able to assist him with spot guidance for enhancing the yield of crops.

Farmer and the New Varieties of Seeds

Any farmer would be greatly interested in new varieties of crops. The Punjab/Haryana farmers were so impressed with CYMMYT wheat grown in the IARI Research Farm for testing in the early sixties that they even stealthily took some seed for growing in their own farms. Mashuri rice from Malaysia came that way. So was Canola from Canada.

When Sunflower was introduced with a great fanfare to tackle the vexing problem of vegetable oil, the farmers were easily accepting the same. However the yield started declining. The enthusiasm of GoI also started dwindling. But a few enterprising farmers of Madhya Maharashtra did not give up. I happened to travel those areas in early '80s. On enquiry I found that the farmers were very choosy in selecting the seed for the next crop. They were only choosing the seed from the medium size heads, avoiding small as big heads. And that made it. The yields did not decline. The GoI, by that time could realize the

importance in the quality of the seed and revived the programme with large-scale import of quality seed from the Continent (Europe).

Similarly when the State Agricultural University was imposing long duration Ganga hybrids of maize, the farmers of north Telangana opted from the Pioneer seed, which yielded bold yellow seed of their liking. The yields were good and the fodder remained green even at harvest. Similar was the case with Mashuri rice.

Somehow the State Department of Agriculture and the Agricultural University were not kind to either of the two varieties. The normal subsidies extended to HYVs were not allowed to them. In spite of this, the farmers were happy with these two varieties of seed. It took a senior Bureaucrat, Sri B. Sivaraman, then Member, Planning Commission to remark on the OSTRICH view of the state R&D on these varieties. Eventually, the germplasm of Masturi and varieties of the look-alike of Pioneer maize were also developed.

The above instances clearly indicate that the user (farmer) has his own idiosyncrasies and the R&D MUST adopt / adapt to the same in the service of the farmers and the Nation, at large.

Seed related R&D Efforts

The R&D efforts in seed started with the first release of Ganga I and three other hybrids of maize during 1960. Later hybrid sorghum (1964) and hybrid pearl millet (1965) were introduced. The first hybrid of cotton came in 1970. The high yielding varieties program was launched in 1966 by GoI. Then came the transgenic Bt-cotton through DBT in 1997. Research on Bt cotton was initiated at CICR in 1998.

The NSC was established in 1963. Several SSCs were set up during 1979-80. Concurrently Private Seed companies started, primarily thriving on public hybrids. During 1989-94 Private Seed companies started investing on R&D.

The GoI announced New Seed Policy in 1988. MNCs were enthused. In the early nineties the GoI prepared Plant Breeders Rights Bill and amendments to Seed Act. A National Seeds Policy, 2002 was also formulated and issued by the GoI. Now Andhra Pradesh Seeds Regulation Act, 2004 is being considered by the GoAP.

The status of seed industry in Andhra Pradesh had been ably brought out by the Seedmen Association in June 2004. This brochure includes some suggestions for strengthening the Seed Industry in the state. The August 2004, the Centre for Sustainable Agriculture, Hyderabad alongwith several other NGOs formulated their responses on the proposed act of the state.

While providing chronologically the various events related seed industry, I must hasten to add that it is not my intention to get into the details on merits or demerits of these interventions. However certain issues as I perceive as important are placed below for consideration by this August house.

- Earlier there had been an argument that crop varieties evolved under better endowments would yield better even under low fertility or poor environs. But research data now generated do not support this concept. Hoffmann and Parsons of Australia argue when once the environmental stress is wider between the two situations, the phenotypes developed in better environs may not do well in poor eco-regions. And this is why there is a need to evolve crop varieties separately for less endowed areas.
- As pointed out earlier, in the State only 29% of the total requirement of seed is distributed during the last year (2003-04). There is ample space for many of us to contribute in bridging this vacuum. The farmer would naturally be the first priority person. Then comes the Public followed by Private sectors. The Acts do provide necessary regulations for each of them, clarifying their roles and activities in the enterprises related to seed. But often the ETHICS are ignored. Many a time the ‘Laxmana Rekha’ is crossed.

During one of my visits to Japan, I was seeing some of the trials on a newly developed vegetation-derived hydrophilic polymer, being conducted on the farmers’ fields jointly by industry and the Federal Government of Japan. I put a question as to how these companies were chosen. Was there any set of rules for the researcher? The Japanese scientist shot back saying “What rule? Are not these industry personnel Japanese? They also have a commitment to the nation”. I felt that I became small. This incident clearly indicates the ethics and the “Lakmana Rekha” exist for one and all of the Japanese. That is why such a small country is one of the powerful nations in the world.

The Public sector can get away with their acts with much less accountability. When I was in the Ministry of Agriculture, GoI the budget for the Ministry was being looked into by Shri V.P. Singh, the then Finance Minister, GoI. He was questioning our Ministry as to why he should allow any expenses on Mini-kit Programme. All of us were stunned. The he said he had reports that the NSC and SSCs supply poor quality seed (that would make up their otherwise losses) for the purpose. We pleaded that this programme is the stepping-stone for introducing crop varieties on a large-scale and so we would take care in future not to allow such misdeeds. He reluctantly approved the needed budget.

There are several Private sector groups / companies that have swindled the farmer and more often even vanished. What worries us is that such misadventures by a few and that too smaller units bring a profound ignominious image on Private sector as a whole. This is happening even with NGOs. Some black sheep. The Seedmen Association needs to find ways and means to correct this malady.

The farmer is allowed to save, use, exchange, share, and sell farm produce of all varieties of crops with a proviso that he shall not be entitled to sell branded seed of a protected variety under the brand name.

Similarly the free import of seeds of vegetables, flowers, ornamental plants, cuttings, samplings of flowers, tubers and bulbs of flowers by certain specified categories of importers is allowed with necessary quarantine checks. I am reminded of an important event in the Question hour of Lok Sabha. A VIP Member of Parliament (MP) from Karnataka was concerned as to why his import of cabbage and cauliflower from USA is being questioned. As per the New Seed Policy under OGL, the individuals are allowed free import of 1.0 kg seed of vegetables. But the MP was importing several kg of seed in *benami* transaction. When it was brought to the notice of the MoA, this had to be checked.

Thus in all cases, there is scope for abuse of the provisions which need self-imposed discipline than governmental supervision and checks. The latter can lead to corruption and/or delays.

Role of Agro-based Industry is also vital in the seed industry. In Saurashtra the vegetable oil industry stores bunch varieties of groundnut for exchange with runner type seed on bartar basis when the season for sowing groundnut gets delayed beyond a fortnight. This

agronomic management is needed as sowing late of runner type groundnut would be facing terminal moisture stress. However the bunch type, which is shorter in duration, meets the contingent situation leading to a win-win situation of farmers as well as industry.

Similarly the *gaur* gum industry in Rajasthan is prepared to help in production of improved seed of *gaur* on a no-loss-no-profit basis for distribution to the farmers.

Such options need be looked into in our state as well. An example could be the high yielding (elite) plant material supply of *Jatropha* and *Pongamia* could be taken over by the Industry dealing with the bio-diesel. Such a tie-up exists between WIMCO and NW India irrigated farmers who grow *Poplar* for industry. They have buy-back arrangements.

- WTO, AOA and globalization have come to stay. On the other hand the demand for even fine cereals (Rice & Wheat) is also declining. Vertical growth in yield of these crops is distinctly possible with better quality seed and improved water and nutrient use efficiency. As desired by NCA, the area under these two cereals can be reduced even without sacrificing their production.

Globally competitive advantage in production systems only has to be considered. Several examples are available. When Israel found their Mandarins are not able to compete with those of Spain, they felled all the Mandarin orchards and moved to floriculture. When Australia identified a large gap in supply and demand for pigeonpea in the global market, much of their R&D centred round pigeonpea. Similarly when Canada felt they would not be able to compete with USA in wheat production, they shifted to Sunflower and Canola – the vegetable oils – which has an ever increasing global demand. So what is needed of us to tune our own R&D, keeping competitive advantage as the case in point.

Quality of the produce for sale is important both for internal as well as international markets, more so for the latter. We have several instances where our produce is either rejected or downgraded at the international level. Prior to change in administration, one shipment of wheat was returned by Iraq on the ground that the quality of the grain is not meeting the standards. With reduced recovery of curcumin, turmeric market in our state is affected. I know that unless the quality of fruits (pumpkin and banana) is uniform and superior, they fetch very low prices in developed countries like Japan. The cloves and cardamom of India is no match to the quality obtained from Malaysia and other far-east

countries. These problems of quality accentuate the problem of low yields to compete in the International markets. As pointed out earlier we have to limit production of at least the exportable commodities to the ideal ecological niches and produce them with Integrated Crop Management Systems. In most cases, the farmer tends to extract more from the mother earth and give little back for its sustenance. Such systems are not sustainable. This has to change. The Seedmen can enthuse the farmers so.

To be competitive, we have also to produce commodities that would have higher demand. Coarse cereals as animal feed for the ever-growing meat production in China is one example. The organic foods to meet the green consumers requirements is another possibility. The medicinal plants (e.g. *Aonla*, *Sarpaganalla*, *Aswagandha*), aromatic plants (e.g. *Nimmagaddi*, *Davanam*, *Vetiver*) and dye plants (*Nallasandra*, *Jappa chittu*, *Nilli*) are a few examples of plants that can be grown even by smallholders, but as a group so as to get bargaining power for marketing.

- Similarly with the ever-increasing demand for milk and the flourishing dairy, green fodder would be in great demand. Seeds of Napier grass and legume fodders like berseem require our attention. And to meet the ever-increasing demand of meat of small ruminants, improving silvipasture systems is also required. So seeds of fodder trees (e.g. *Subabool*) and grasses (e.g. *Cenchuis ciliaris*) and legume fodders (e.g. *Stylosanthus hamata*) must be made available.
- A plethora of options and a whole gamut of the needed seed are presented above. They include cereals, pulses, oilseeds, agro-industry based crops like guar and cotton, value added organic products (medicinal, dye and aromatic) and feed and fodders besides vegetables, fruits and flowers. What is first needed is to appreciate our own capabilities and efforts and try for *in situ* development of the needed inputs, seed in the present case.
- The Public sector, I feel, should move away from cereals and embark on huge seed production programmes of the other agricultural commodities. (pulses and oilseeds in particular). Industry must get involved in agro-industry based crops and the value added organic products. The State Dairy and Meat Corporations must be addresses the seed requirements of feeds and fodders. All the horticultural needs must be through entrepreneurs registered under the supervision of the State Agricultural University.

- The farmer, however, shall continue with his right to save, use, exchange, share or sell all varieties as cited earlier. Similarly the hybrid seed production can be the domain of those with necessary skills and parent materials needed for the purpose.
- In any case there need be no ‘free lunch’. What all the farmers need is timely supply of adequate quality seed.

A revisit to the Research in Seed Production

The HYV/HYB seed so far produced are meant for better environs and need substantial external inputs for fuller expression of their potential. Several ecological changes occurred with their introduction. To name a few:

- Being shorter in duration, the natural pest – predator cycle was disturbed. With the dense vegetation (leafiness) under-canopy humidity increased several fold. Being high feeders, the nutrients in the vegetation was generally more. Both scenarios attract more pests and diseases. The root systems happened to be deeper. In shallow soils and subsoil saline areas they fail to perform well. For instance, the shallow rooted yellow sorghum still is preferred by the south Telangana farmer.
- With short vegetative phase, the agronomic flexibility in sowing is reduced. Any stress of moisture during the grand growth period effects the yield of crops. So timely sowing assumes great importance for the HYV / HYB crops.
- Being short in stature and high in nutrients, the rice straw of improved varieties needs annual replacement in roof thatching.
- The quality of grain and fodder of *Maldandi* (*rabi* sorghum) is still the priority of the farmer. Similarly the glutinous rice is important for the NE tribal farmers. Such preferences are also seen in pearl millet grown in arid zone and ragi grown in south Karnataka.
- These traits cannot be ignored in any plant breeding programme. We need not feel shy to go back to some of the traditional varieties for use as germplasm in our crop breeding programmes.
- When the Phaseolus grain legumes (black gram and green gram) were introduced in rice fallows and as a contingent crop when River Krishna command area could not get water in last *kharif* (2003), all areas were put to these pulses. The ecological niche, of these crops, however, demands avoidance of salt affected areas. In the Krishna

command the areas covered with Paleochannels have better quality ground water. In the other areas it is highly salt loaded. Such soils have high Redox Potential (low aeration). And Phaseolus pulses should not be grown. Such fine differences are to be kept in mind by the Seedmen who advise the farmers to grow these short duration pulses.

Crop varieties of the Disadvantaged

What is more worrisome is the total side tracking of the ecologically and economically disadvantaged areas.

In Andhra Pradesh more than 80 percent farmers are small and marginal and own about 40.0 percent of the cultivated areas. We cannot ignore them and their needs.

I would like to recall the comments of Brady, a reputed soil scientist who called for new varieties of crops for infertile soils. He said that in developing countries the most critical constraint on production is problem soils which limit crop yields. This is largely due to the infertile soils. The HYV / HYB are inapplicable in soils with adverse conditions.

Genetic modification and improvement of crop cultivars would be inexpensive and dependable means of development of low-income farmers.

Brady opined that extra food must be produced under inferior soil, climate and biological conditions. So new varieties need be developed and improved nutrient, pest and water management practices identified for sustained production of food crops in these disadvantaged areas.

Similarly Evans pointed out that the future vertical growth in yields has to come from less developed countries (LDCs). The present low yields in LDCs are largely due pests, diseases, weeds and climatic stresses. Biotechnological approaches alone can resolve these issues, thereby reducing the costs in production.

Present scenario of Transgenic crops

As on time, some of these traits are incorporated in the transgenic crops as seen below

Trait	Crops	Area planted in Mha (2003)
Herbicide tolerance	Soybean, maize, canola, cotton	49.7
Bt insect tolerance	Cotton, maize	12.2

Crop wise the situation is as follows in 2003

GM crop	Area (Mha)
Soybean	41.4 (55) ★
Maize	15.5 (11)
Cotton	7.2 (21)
Canola	3.6 (16)

★ Figures in parenthesis are percent of global area under the crop

Countrywise GM crop area is as follows in 2003

Country	Area (Mha)
USA	42.8
Argentina	13.9
Canada	4.4
Brazil	3.0
China	2.8
South Africa	0.4

From the above data, I like to bring to the notice of the august house that North and South America occupy large areas of GM crops, soybeans being the most predominant crop. Herbicide tolerance is the important trait in the GM crops. This can be appreciated when we look at the increasing costs of labour to be employed in weed control. By another five years, Clive James of the International Service for the Acquisition of Agri-biotech Applications projects the area with GM crops to be 100 Mha covering 10 million farms in at least 25 countries.

While I do not like to get into the present controversy on Bt-cotton, I like to still say that transgenic crops with the traits as suggested by Evans and Brady (*vide supra*) would be relevant to our country. Our R&D efforts should continue in this area.

I also have a nagging feeling. When GR was brought in, several changes occurred. The sane advice of C.N. Rao, Director, Indian Statistical Institute, Kolkata (old Calcutta) on use of lesser external inputs so as to see that more area and more people are benefited was set aside. His suggestion also covers the Law of Diminishing Returns. The higher use of water, fertilizers and consequent use of pesticides lead to unsustainability of the GR. Further GR lead to the loss in biodiversity, so relevant in agriculture. Costs of production increased with time. With increased production of rice and wheat, PDS came in. Nutritional security was in jeopardy. Health, human health in particular, was affected. More expenses on healthcare.

This was accentuated with highly subsidized availability of rice and farmers started moving to commercial crops at the cost of nutritious cereals. Not many activists were serious on these issues.

Now when transgenic crops are coming up, suddenly a spurt is seen deliberately against the genetically modified crops. On the other hand except in the Continent (barring Germany) all the nations are competing for adoption of these crops as presented by Clive James. Perhaps we need to have an objective look into the scenario and adapt the same to suit our convenience. We cannot, I repeat cannot, ignore GM crops for the future. However, the hype, secrecy, fear and conflict in certain quarters on GM crops need be demystified. Science and Society must work together to share the direction in which research processes opened up to scrutiny and debate from the start, as pointed by Wilsdon and Wills of United Kingdom.

A challenge always lies ahead for the researcher. This is true even with the seed. At least three examples need our attention.

First is the crop diversification needed in view of the WTO, AoA and globalization. Two options are vertical growth in yield of rice and wheat by moving up on the front of genetic potential and the second is look for crops of competitive advantage after identifying the needed ecological niches for them.

Second is the early / advance warning systems alongwith correctives when we move to new crops and new production systems. The unsustainability of GR is a case in point. Now MSSRF tells us that the present system of crop production in the Punjab may lead to food insecurity in the state by 15-20 years. In other words, soil health problems must have been anticipated. Similarly the new pests and diseases. TOPSO virus in sunflower, Botytis in castor grown in Telangana are some of the examples which were not anticipated.

Third is the nutritional insecurity in the rural areas. The crop diversification from female (food crops) to male (commercial) crops, as pointed by my esteemed colleague Lalitha of Centre for Environmental Concerns lead to change in food habits and finally to poorer health. So is the case with chemical agriculture. Organic component in the production systems is bypassed. Soil health is in jeopardy.

All these lead to a paradigm shift from ecological security to economic security. If the systems are to be sustainable we must reverse this shift.

Rainfed Farming and the Seed Requirements

Being a worker in rainfed farming, I like to place a few thoughts over the needs of the farmers practising rainfed farming. In the state about 60% of the cultivated area is rainfed. And in rainfed agriculture, the by-products in crops are as important as the economic component. Some examples:

- The stalks of pigeonpea and cotton are used as fuel
- The haulms of groundnut is good fodder. It fetches even more money when the drought prevails
- The stalks of most of the cereals are the roughage for livestock. Some are used for roof thatching
- The husk after dehulling of the grain crops is used as feed
- So is the case with the oilcakes. They are also used as manures
- Bran (maize and rice) is extracted for vegetable oil
- The quality of not only grain, but even of fodder are very relevant for the farmer
- And so on

More often our plant breeders feel happy with the economic component only as the end product.

Similarly the poorer sections (a vast majority) of the farmers grow several crops in mixtures. While the traditional varieties suit well for such systems, the HYV/HYB may not be suitable. This is because the local varieties are bred for individual performance while HYV/HYB perform well in a community.

Even in intercropping, for example groundnut + pigeonpea, the farmer goes for two things. First he opts for wider row ratios. Second he likes to have varieties of pigeonpea that pick up vegetative growth after 50-60 days of the growth of groundnut. His logic is the shade and the moisture retained around pigeonpea would reduce the yield of adjacent rows of groundnut. And groundnut is the main crop for him.

There are several other examples. All these go to suggest that the varietal choice of the small and marginal rainfed farmers are at great variance. The Seedmen can argue that the demand for such seed, even if evolved, would be too small. But I want to insist that for him, representing a majority of the farmers, it is everything. The R&D can no more ignore such

requirements. If biotechnology can provide answers to such needs Public Funded Research must be immediately initiated.

Coming to the tree component at least two issues need our attention. One is the quality and the second is the ecological niche for the tree under consideration. The SMF can be easily enticed with huge monetary returns for the tree under sale. Unless the two issues are properly addressed I consider the salesman / advisor as unethical. After all, the tree starts showing results only after 3-4 years time. This is the reason why a suggestion was made earlier that promoters of trees MUST be registered and supervised by the State Agricultural University along with the Department of Horticulture.

Lastly in our endeavour to wean away the well irrigated farmer from growing rice, we will be advocating several alternative crops. And for this we need to be discreet and encourage community centred production systems for easy marketing. The needed infrastructure MUST be provided by the Government.

In rainfed farming droughts are not uncommon. The problem is however accentuated with denudation of vegetation, depletion of soil organic matter and enhanced emission of greenhouse gases. Such events are said to lead to more frequent droughts, cloud busts, skewed distribution in rainfall and so on. Carbon credits / sequestering is being encouraged to reduce the greenhouse gas emissions. Till we achieve that, we have to face the enhanced disturbances in the weather. We need to prepare the farmer for contingent cropping. And for this we must evolve Seed Banks. The Seedmen Association did provide the seeds needed for such Seed Banks. The suggestion I like to make is that such seed if used for contingent cropping leads from nothing to something. If not, needed for that season, the seed may be sold out as grain and the difference in costs are met from the Government exchequer. In 1987-88, when the drought was all pervasive except in Maharashtra and Orissa, the MoA, GoI launched contingent cropping to capitalize on the later rains by supplying seed of blackgram on a large scale. The net gain in this single venture was of the time of Rs. 2000 million, as worked by Subbiah, then Director in the Ministry.

We are Second to None

In one occasion, I was discussing with Dr. Mashelkar, now DG, CSIR (then Chief of National Chemical Laboratories, Pune) on the 'Jalshakti' (a hydrophilic polymer), which he

was struggling to put for use by the farmers, gardeners and others. Our NARS system had not been very positive in its use. Dr. Mashelkar, in desperation, said had if this product originated from the West, our scientists would have jumped at it and be on cloud nine instead of negating it. I am also reminded of the undue haste in paying floral tributes to Golden Rice for its vitamin A when the same is available locally, particularly through drumstick. We should respect our scientists and their work. The scientists include Public and Private Funded groups as well as NGOs and the farmers. We are second to none. We can depend on ourselves. This is true even with us where the users are varied, the eco-systems are heterogeneous and the idiosyncrasies of users and consumers also range over a wide spectrum. Such a menu of variability calls for location specificity. And our Indian scientists only know the variabilities. So varietal improvements of crops are best achieved by a close liaison of NARS, Private Sector, NGOs and Farmers. It should be, however, obligatory to all the Seedmen to place the ecological niches for each of the seed he is producing or selling.

The present gap of 71 percent in the coverage with improved seed can easily be bridged.

Epilogue

Andhra Pradesh is the seed bowl of India. As per the estimates of the Seedmen Association, 27.36 lakh quintals of seed were produced in the state during 2003-04, of which 56.6% was locally distributed. The total seed requirement is about 53.28 quintals, indicating only 29% seed requirements are being met.

There is a great scope to produce more seed to fill the huge gap of 71% requirement through various agencies. Different actors (including the farmer) can mutually agree to produce the various types of seed-crops, fruits, vegetables, flowers, MPTs, feeds and fodders, medicinal, aromatic and dye plants, bio-diesel, etc. Some suggestions are made in the text.

Ethics in the business of seeds have to be evolved from within and the government, at best, can play a supervisory / advisory role. Regulatory role is equally important, but should not be coercive, lest corruption creeps in. All Seedmen must be able to identify the ecological niches needed for each crop and variety and be able to advise the farmer accordingly. Let us be farmer-friendly and prevent avoidable losses to him.

There is urgent need to initiate research on transgenic crops, particularly for the disadvantaged areas incorporating needed traits in tolerance to herbicides and pests and diseases and for better performance in poorly endowed areas and moisture stress situation. It is also time to have breakthrough for higher genetic potential, particularly of food crops. Till that time advocacy of improved agronomic practices concurrent with spot guidance by the Seedmen will go a long way in enhancing crop productivity.

Finally seed should be everybody's business and all of us have enough space to contribute in sustainable, ecological and economic development of the Farmers.