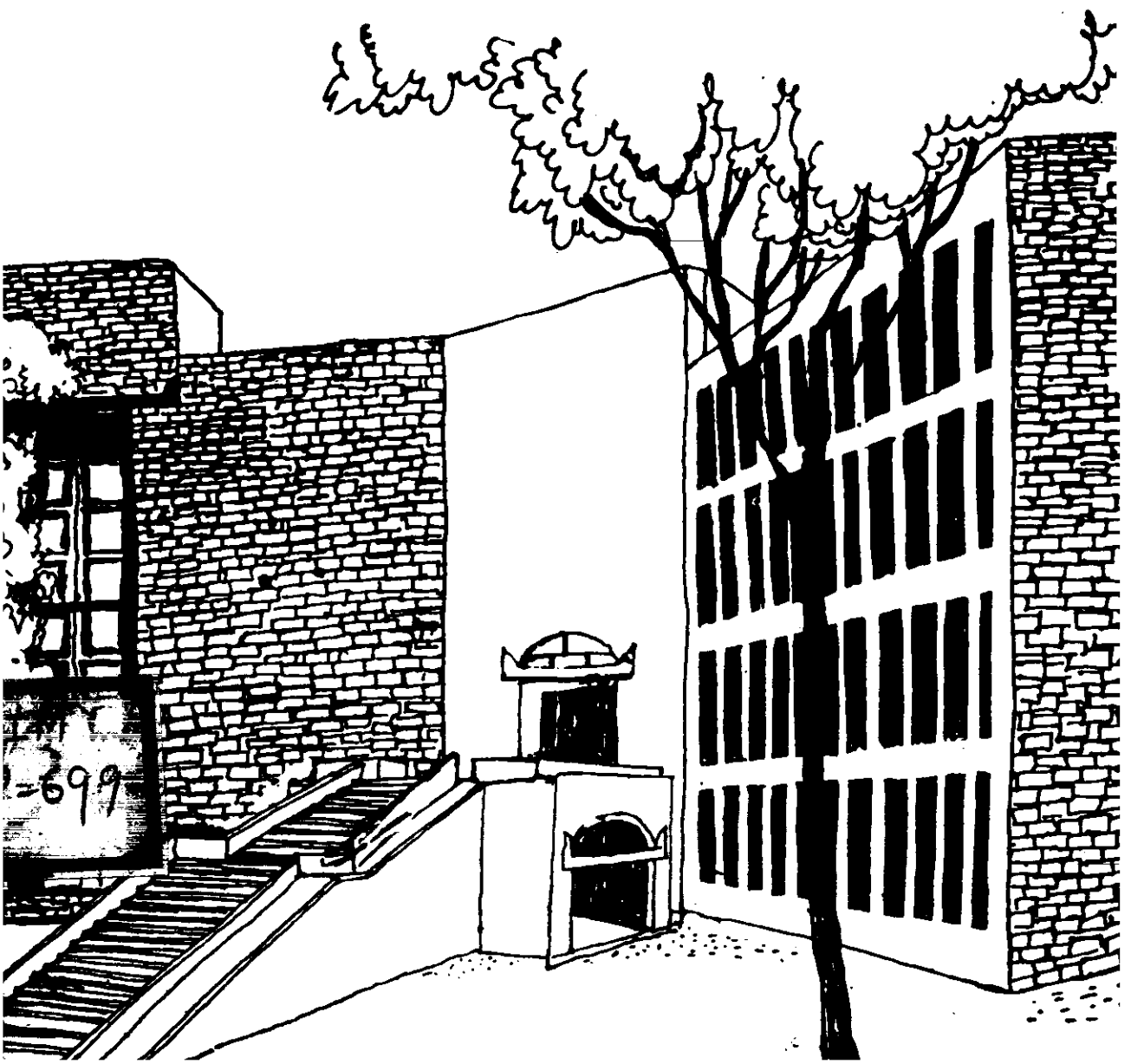
Working Paper



SCIENTIFIC PERCEPTION OF FARMERS INNOVATIONS IN DRY REGIONS: BARRIERS TO THE SCIENTIFIC CURIOSITY

By

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Scientific Perception of Farmers'innovations in Dry regions : Barriers to the scientific curiosity *

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Perception of any pheneomena is nearly impossible unless mental sock for adducing a meaning to that percept exists .The theory comes fir ,data later as Popper put it . Surprise is a necessary condition fo discovery . But why do not we always see what we observe ? Is it som thing to do with the instrument of seeing rather than seen-- th object ? Or is it that the context which determines the content i not right ? Is the problem then of redefining the context to deriv new meanings from the oldobserevation ? Does it imply that dat exists in wait to be interpreted ? Where do we really begin to star seeing not different things necessarily but differently ?

Introduction

In a recent study(1) based on the field work in Semi-arid parts c India we had asked mainly the biological but some social scientists t narrate any practice of the farmers which had intrigued them . Th scientists included those engaged in dry farming research Haryar Agricultural University (HAU), Hissar and All India Coordinate Research Project on Dryland Agriculture(AICRPDA) ,Hyderabad.

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* Anil K Gupta with N T Patel and Rekha N Shah ,1987 Matching Farmer objectives with Technologists objectives in Dry farming Regions : A exploratory study of the scientific goal setting ;Centre fo Management in Agriculture,Indian Institute of Management Ahmedabad , mimeo. This is sequel to first author's work in this field during 1979-1986. The field work and first draft were completed durin 1985. Comments from Drs. Y P Singh, Jodha, Biggs,Chambers, Box,R Singh , Vankateshwaralu ,Sanghi,SP Singh ,G M Desai ,D K desai, Bo ,Richards and many other colleagues from CMA on the research proposa in 1984-1985 were extremely helpful .Usual disclaimers however, appl presented at a workshop on Farmer Participatory Research at ID Sussex,UK,July 27-31,1987.

Objectives

Our purpose was first to understand whether the scientists often blamed for ignoring farmers' innovations were really unaware of these. And then to speculate as to why did they not go out to test the same formally (or build upon it if formal test was not required) if indeed they observed some of these innovations or intriguing practices ?Thus why did not scientific curiosity lead them to pursue the issue further?

Sample, area of study and methodology

The sample included sixty one scientists (24 from Hyderabad ,24 from Hissar and 13 from dry farming research station of H A U ,Hissar at Bawal,District Mahendragarh).As many as twenty four of them reported some such practice which they considered innovative .Majority of these were from Hyderabad (15/24).The scientists were from different disciplines ranging from plant breeding ,genetics ,agronomy,agricultural engineering to nematology ,agri-economics and sociology . We must express our pleasant surprise at such a high proportion even though it included some very skeptical comments.

The main method of eliciting information was to interview the scientists besides eliciting their response with the help of a structured schedule .The findings have been shared with the respondents in the form of a seminar at HAU in 1985 but remain to shared with scientists at AICRPDA ,Hyderabad formally . To that extent the results are tentative and need to be viewed with necessary caution

discussion and speculation

It has been recognised that several variables may influence the way the reserch community perceives the issue of peasant knowledge and

possible science underlying it . These could be values of the scientists and their background (Busch and Lacy ,1984) , preconceived notions of the scientific community (Verma and Singh,1969) ,glamour for sophisticated and complicated methods , dislike for simple technological alternatives (Hiranand,1979,Kumar and Nand ,1980) , unscientific assumptions about the farmers'constraints and opportunity matrix (Sanghi,1987 ,Jodha 1985 , Gupta 1980,1981,1984) ,social and intellectual environment and hierarchial exigencies of the scientists (Whitley,1983) ,need for lesser concern with the social responsibility of researcher (Rutton,1982) or higher concern (Oasa and Jennings ,1983),urban,termac,seasonality and other biases (Chambers ,1983)etc. We have added several more variables in the present exploration such as age ,economic class background, ecological background from which the rural born researcher came , professional experience ,disciplinary background etc. We do not intend to present the results with regard to the interaction of these variables with the perception of peasant kanowledge in this paper . These results will be reported separately .

We present the empirical evidence only with regard to the following issues :

1. Classification of perceptions

Some scientists (about 30 percent in our case) do percieve unusual practices of the farmers . The observations could be classified as a) skeptic or cryptic b) Critical including the practices considered Sub-optimal or unscientific and d) approving that is the practices are acknowledged as useful or good . The detailed practices are given in Table 1 to 4 (see annexure) .

2. Need for drawing science out of peasant practice

Possible reasons or hypothesis explaining lack of conversion
perceived practices into experimental or other type of verificatio
learning trials so that science underlying rational practices a
dogma behind not-so-scientific practices may be derived . We are n
suggesting that on station or on farm trial is the only form
scientific testing . In many other sciences the test are done
hypothesisng certain relationships and searchimg for the same in an
related region where other things are similar . Such experiments c
also be done . The mathematicians perform even mental experiments
which having defined certain properties of a phenomenon ,oth
properties are sought to be derived (the famous case is that of t
Poincare's conjucture in topography which has baffled t
mathematicians for the last 83 years ,Taubes,1987). As Riedl puts
,"Like probality and comparison,causality proves to be an priori
individuals and a posteriori of their tribe ,which has learnt
"(1984:102).Lorenz had highlihted the importance of analogy as
source of knowledge (1984:103). Thus our assertion about the need f
drawing science of a technological practice must not be misunderstoo

method based on the logic of 'compare and contrast' provides equal
rigorous testing ground as any other scientific method . However, wh
we want to state unambiguously is that the mere documentation
peasant practice is not enough even if it is wide spread. This view
linked with our plea for transferring <u>science</u> and not just t
<u>technology</u> to thr farmers .This would be possible only if t
continuity of scientific trail between his practice and the n

knowledge if any can be established (2).

The term science is being used here in most simple sense as a process of distinguishing a chance from necessity.Not that this is always so straight .The scientists' colleges i.e.the peer review groups also follow certain rules. But who defines them and how long they remain valid may influence the type of practices come to be accepted as scientific .The formal scientific methods are not error free but they reduce the scope of error if pursued properly .The combination of stimuli from left and the right side of the brain after all is all that we are talking about .That is the combination of analytical and reflective methods of drawing inference .

The ground rules for classifying the peasant knowledge and linking it with 'scientific 'method/s remain to be developed . We are trying to only underline the danger inherent in romanticising the technology part of the peasant practice without linking it with the mainstream natural science pursuits .

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(2) It is interesting to recall here what many British travellers had recorded that some of the technologies developed during 18th and early 19th cnturies like turning plough developed in Austria in 1662 and England ,1773 were surpassed by the already existing technologies in India . Halcott had provided the drawings of drills developed by the farmers in 1795 and 1796 to sow crops at specific interval in India which seemed to be the best available at that time any where (Dharam Pal,1983,229-256) .
One resaon for these technologies not leading to advancement of science in East may have been the methodological or experimental ethic which spearheded the western curiosity . Thus while decrying these formal methods one should not forget to take historical experience into account . The methods as we have argued in another paper (Gupta,1987) are intimately linked to the phenemnological process of linking technology with science . As Whitley has very ably demonstrated that science has progressed from technology and not vice versa . The breeding as a technology existed before Mendel discovred the principles of selection and seggregation .(Also see Balasubramaniam,PPST,1987)

Classification of peasant practices

The search for the classification rules proved abortive when we tried to derive it from the way the scientists perceived the peasant practices . We had following alternatives

a) To use a simple classification which was utilitarian : which practices were reasonable , sub-optimal given the state of knowledge, 'unscientific ' in terms of the given rules of science, and acknowledged as innovative .Here too we faced a problem that many practices which were considerd as innovative were not taken to the next stage of abstraction which can enable diffusion of the principles behind this innovation to other farmers by the farmers or researchers or even extension workers

We used this classification in this paper just for the immediate convenience . In retrospect it appears defective.

b) If the practices are response to certain stresses and repertoire of alternatives as well as endowments then specification of these conditions would be necessary . This would imply that we should have collected data from the scientists about all the three aspects and then classified the peasant practices on the basis of typology of stress,stimuli and resources (and may be scale too) . We did not do it while collecting data and thus this basis of classification was not available to us .

c) The experimental ethic of the farmers and artisans, and it's appreciation in terms of the extent conceded by the scientists could have been another basis . This would require that we first define the context in which the concept of an experiment is defined by the farmers and then relate it to the judgements of the scientists.

d) The classification could also be based on the basis of prio

validity of practices . The practices which are considered valid by one of the group i e scientists or the farmers vis-a- vis the ones which are considered invalid by both or valid by one and invalid by another . This method was followed to a limited extent by Singh and Verma (1967)and more elaborately in the study by Hira Nand (1979) and Verma (1986) but not by us . it remains an useful way of first cut . Further clasifications could have been built upon it .The limitation of this method is that scientists may consider a practice valid and not scientific i.e.they may not be able to explain the science behind it .Likewise the farmers may consider a practice as invalid without sufficient basis or logic but simply because it may contadict what may be an universal practice . After all we must not forget that the idea of Earth moving around the Sun was similarly rejected by the large mass of people just on this account . Thus rejection without experimentation in some sense by either party may remain speculative. What we are trying to suggest therefor is that depending upon the purpose of research a svcheme of classification can be followed . Each method offers some insights but at a price which parsimony demands . There can be hierarchy of classifications depending upon the level of aggregation or analysis . This is an area which will benefit a great deal by collaborative work by colleagues in the profession .

We summarise few remarks which to our mind indicate a way of perceiving peasant's knowledge that may be flawed . E.g. Some researchers believed that in the absence of longitudinal data about farmers' practices how could they draw any inference about the validity of any practice . It is like asking a farmer about his heart beat or pulse rate and then not getting a prompt answer doubt his concern for his own welfare . The ability to use an information

determines considerably the way it is indexed . This issue has been brought out by the ethno botanists very well . At the same time we are also talking of two planes of farmers' consciousness . A farmer not knowing about traditional or modern medicine may not have an abilty to use data about pulse rate or heart beat . This information therefor did not have to be indexed or catalogued. The skill for processing this informatiopn did not develop therfor . Many of the apparently irrational conjuctures used by the farmers are a part of his taxonomy which may or may not be functional any more . But they serve one important purpose and that is to help us understand the working hypothesis which may just be correlational or causal .

The critical observations were not subjected to any formal testing or rejection . May be it is not necessary . It depends whether this practice is wide spread and if so does it serve any survival optior any more . Many of us romanticise the realm of peasant practices . Some of these could as well be without any valid basis . There may be cultural ,religious or other historical reasons for continuation of the same . The practices which have been tried and discontinued may have to treated differently from the one about which knowledge exists but they have been either not tried by the respondent farmers or triec but discontinued .Further there are conjectures which may not be valic for the reason they are recalled by the farmers i.e. right things ma be done for wrong reasons . In 1979, in a village Janjariawas o District Mahendragarh a farmer Hira lal narrated to us severa hypotheses about the way the farmers tried to speculate abou impending drought or other natural disasters or pest or other problem (Gupta,1980). They had some way of associating the flowering behaviou

of Neem Or some other weeds or movements of ants with the yield prospects of some of the millets . Quite likely that these conjectures are unfounded or unscintific but what these instances indicate is the possibilty of some speculation going on in the villages about the pheneomenon which they have to live with at times without understanding it .Should we dismiss it outrightly or search behind these apparent absurd conjectures some traces of correlational logic . Perhaps two events which were influenced by the same phenomenon were considered to be related simply because of co variance .The atmospheric humidity may influence the behaviour of ants as also certain other pests as well as vectors of diseases which in turn may influence the yield prospects of certain crops . The issue is to subject some of these conjectures to critical scrutiny before terming them as unscientific .

An Illustration :Early planting of Gram

Early planting of gram was such an instance which we pursued with the farmers after hearing it from the scientists . Farmers reported soil temperature to be one of the main factors responsible for it .

The farmers measured the temperature by either walking bare foot at noon time or by smelling the odour which emanated when while drinking water which fell down on the ground . The absence of burning sensation at the noon time signalled the sowing time for gram as well as mustard .

Another farmer in village Kasauli in Mahendragarh district reported another hypothesis for early sowing. In his view early sowing might lead to higher yield despite wilt attack because the grain filling was expected to be completed by mid february . At this time rise in temperature or strong winds could damage the crop . The risk of this damage apparently was more serious than the other damage .

Whether or not one hypothesis was better than other depended on the experimental evidence or the process of compare and contrast ie Manual Discriminant Analysis.

When we view the cases of those practices which were acknowledged as innovative we take the case of Blade Hoe which was very effective in moisture conservation as well as weed control (Nanad,1979). In this case what was missed was an apparent relationship which seemed to

depended perhaps upon the soil . This question was neither raised nor answered by the scientists who considered it innovative . The possibility of improving upon this design or adapting it to other areas could not arise till such questions were raised .

There are several practices which we have discussed in the main report (Gupta,1987) which necessitate the need for recognising the danger in pursuing the one way process of 'lab to land ' technology transfer approach too much . It may irrepairably damage the experimental ethic as it has happened in case of human health in west as well as east to a great extent . Some of the even common proven medications are out of the active repertoire of many of us .

The need for drawing science out of many of the peasant innovations arises becaue such a thing may extend the frontier of the science it self . The case of giving a vertical incision in cucurbits to induce flowering i.e. transformation from vegetative to reproductive phase is one such example . It is possible that there may exist a relationship between upward and downward flow of nutrients and these functions of the cucurbits . The incision may be disrupting flow of nutrients atleast one way. May be there is some other factor responsible . The issue is that complimentary methods will have to be used as argued by Chambers to link both the heuristics i e the peasants' and the scientists '.

Conclusion

We have argued in this note that many scientists even today perceive peasant practices which they may find intriguing,sub-optimal,unscientific or as innovative .However , their classification is often based on unscientific principles and not always consciously. We have to identify the mainstram scientists who already have this sensitivity and enable them to pursue their curiosity to its logical conclusion. The next step may as well be an institutional

intervention . The legitimacy of 'deviant ' research requires organizational space for such research . The detailed discussion on these issues is clearly beyond this note . It may suffice to state that sevral interventions are required at different levels and simultaneously . the curriculum for graduate studies has to include (which is not the case as on date) sufficient exposure on the subject both by way of history of peasant innovations as well as the methods used by the farmers to experiment and modify the knowledge generated at research stations or even the farm of another farmer. we have to disentangle the role of class from that of ecology in technology generation as well diffusion. The political aspects of resource allocation for research on risky enterprises, small ruminanats vis-a-vis large ones; forming teams around problems with uncertain outcomes etc have to be vigourously pursued if the farmers' knowledge and formal scientific pursuits have to grow in complimentary manner .

Appendix

Table Total Scientist (TS) =

Does indigenous technology have any relevance today?

I Cryptic Answers / Skeptical comment

1. "These technologies are very common for 2 to 3 generations as far as dry farming is concerned. It's the weather which determines the success or failure of a practice."

2. "Old farming practices are very good and well tested since centuries. But a practice which was simple and good 50-100 years back may not be good in present circumstances. And a practice which is good today may not be good tomorrow. Every farmer's practice needs change or modification according to the time."

3. "They are not maintaining any record so while asking for previous practices they couldn't recollect the actual performed practice for e.g. how much labour used in different operations, how many irrigations are applied, how many days are required in different farming operations."

4. "I have not noted any interesting farming practice."

5. "I have not interacted with the farmers. The farmers want perfect dryland technology which suits their pocket to maximise production and income."

Appendix

Table No. T.S. 2

II. Apparently Unscientific Practices

1. Some farmers do not till the fields during fallow winter season with the belief that soil will catch cold if ploughed during winter season.

2. Usually farmers plant the gram crop early in October. Early planted crop suffers more on account of wilt disease.

3. Use of herbicides along with the fertilizer by broadcasting by farmers instead of spraying.

4. Sowing of seed of some crops mixed with fertilizers (particularly wheat and gram).

5. Mixing of fertilizers with seeds then sowing was noticed at farmers field. The practice is followed in gram and mustard crops in dry farming areas.

6. Weeds flora is not removed by the farmers. They utilize the weeds as feed to their cattles. This is the most common sight at farmers fields in dry farming areas.

7. Placement of fertilizer under dryland conditions, seed and fertilizer are mixed together and then sown together.

8. Sowing of wheat after paddy broadcasting (in Andhra Pradesh).

9. Farmers' follow up and down cultivation without taking into consideration of slope. Due to this there is a chance for soil and water erosion.

10. Cultivation of chillies, vegetables and oilseeds (groundnut) which are not recommended by the Dryland Project.

Appendix

Table : 3 .

III. Sub-Optimal Resource Use or Ignorance of Alternative Land Use

1. I have noticed at farmers' field that gram crop if sown late, does not do well and fails due to non-supply of one irrigation on flowering stage which is required for higher yield of late sown gram.

2. Maintenance of proper plant stand under dryland conditions. Very low quantity of seed is used by farmers.

3. Dryland farming is not paid much of attention by the farmers. There is very little choice of crops and farming practices. Because of risks involved farmers do not intend to invest the desired or required level of finance in terms of inputs/operations.

4. The farmers are hesitating to grow or culture the medicinal and aromatic plants though they cultivate reduced that their cultivation is much prostake as compared to other traditional crops.

5. Use of less quantity of seed and fertilizer than the recommended quantity.

6. Poor crops stand especially in peart-millet was recorded at farmers field in dry farming area.

7. Application of fertilizers is nil or very less amount of fertilizers is given in dry farming areas.

8. Moisture conservation practices are not followed in rainfed areas.

9. Use of plant protection measures only for Jowar and Red gram and other crops at the hight of severe damage.

10. Nearly all farmers understand the important relationships between trees and other factors of the farming enterprises: Soil Water Conservation, Soil fertility, crops, drought animals, cash flow, smooth labour requirements. But it seems many factors limit their putting this understanding into routine practice

Appendix - 4

Table I.S.

IV. Acknowledged as Innovative Practices

1. Use of Blade Hoe: In some villages of Hissar and Sirsa districts farmers use a blade hoe for preparation of seedbed. It is a very useful implements as it saves time, labour and at the same time conserves moisture.

2. Use of NAFE (a desi plough) for deep sowing of gram by camel.

3. Growing of sarson (Mustard) in criss cross sowing in gram crop.

4. Paired row growing of cotton.

5. In dryland areas the practice of keeping kharif fallows for Rabi and moisture conservation methods followed by farmers are very scientific. (ii) The sowing of Bajra crop at the time of pre-monsoon showers wherever it occurs in the month of June is correct. (iii) The practice of sowing of gram with a specially designed traditional plough called 'Nai' is a good practice.

6. Farmers in the region sow Mustard crop with desi plough. To cover the seed in the furrows farmers attach a small turig behind the plough which goes on covering the seed. This ensures good germination.

7. Acceptance of 2:1 ratio for sowing Jowar and Red gram.

8. Ploughing the lands 2 or 3 times after harvesting the crop.

9. Removing the water from fields after 2 or 3 weeks of plantation. (Paddy in A.P.)

10. Covering the seed of tobacco at the time of seeding (A.P.).

11. Even with slopes of 5-10% cultivates leaving strip (allowing grass to grow) across the seope.

12. Farmers in Telengana (semi arid belt) area are following Sorghum-castor rotation (2 years rotation). This helps to use the soil nutrients to an optimum level and a balanced take up of nutrients takes place uniformly in the soil zone.

13. Farmers' control weeds in castor or jowar (Sorghum) by blade harrowing in the off season i.e. during premonsoon season. This helps in reducing weed proble in the ensuing crop season.

14. Farmers apply fertilizer or farmyard manure only to castor and do not apply fertilizer or FYM to Sorghum; because castor is remunerative (commercial) crop to farmer; that is why he takes rigorous care on castor. Sorghum mainly gives fodder and little grain also for his own consumption and do not fetch much money.

15. Mixed cropping i.e. mixing the seed and then sowing in the same rows.

16. Early sowing (with pre-monsoon rains in May) of Sorghum to avoid the problem of shoot-fly and a kind of bug in ned soils of Telengana region.

17. Delayed sowing of castor (during Mid July - end of July) to avoid attack of red hairy caterpillar.

18. Tied ridging, harrowing etc. as a part of inter-culture operations to conserve moisture in maize crop.

19. Conservation drain system as a substitute to graded bunding in kharif black soil of Telengana region to avoid the clash with field boundaries.

20. Plantation of <u>Butea monolperma</u> as agro-forestry system (on field bunds in cultivated kharif blocks). The species seem to have least competitive affects with annual crops.

21. The water harvesting system like percolation tank in medium rainfall area (500-800 mm); Khadin method in low-rainfall area (below 500 mm) and small farm pond in high rainfall areas (above 800 mm).

22. <u>Sowing with pre-monsoon rains</u>: Certain crops like Sorghum in red soils of Hyderabad, maize at Hoshiarpur, paddy in low lands at Ranchi are preferred to be sown with pre-monsoon rains. Scientific analysis has shown the following advantages associated with such a practice:

- Efficient utilization of mineralized nitrogen
- Avoidance of pests, like shoot-fly and earbug in sorghum
- Timely seeding of second crop in sequence etc.

The practice, therefore, should also be continued in the improved system of dryland agriculture.

23. Early interculture operation: During rainy season, first operations of interculture for weed control is done within 2 to 3 weeks after sowing. Such an operation has a special advantage as there is no need to remove weeds out of the field after the interculture operation. In situations where interculture is delayed, there is a greater risk of re-establishment of weeds with subsequent rains if they are not removed.

24. One farmer obtained good crop of intercropping (Castor + Redgram) with two rows of castor and one row of redgram.

25. Farmers obtained good yield of Sorghum by taking sowing with early monsoon in the second week of May (12th May), whereas the recommendation of the scientists is after 24th May after on set of normal monsoon.

26. In Arid Zone: (of Rajasthan): Use of tractor and dis Horrow for sowing purposes practically by all the categories of farmers.

27. In dryland Tracts of A.P.: Broadcasting of green gram.

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