Problem Diagnosis and Research Prioritisation of Sweet Potato in India

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Abstract

Sweet potato (*Ipomoea batatas*) is one of the world's most important food crops in terms of human consumption, particularly in Sub-Saharan Africa, parts of Asia and the Pacific Islands. The major sweet potato growing countries are China, Uganda, Nigeria, Indonesia and Vietnam. In India, it is cultivated in many states, but a relatively more concentration of this is found in Odisha, Uttar Pradesh, Bihar, Jharkhand and West Bengal. It is cultivated in an area of 0.113 m ha in India in various types of production systems. In order to have need based problem oriented research programmes on sweet potato and to utilise the limited resources effectively, an attempt was made to diagnose the problems and prioritisation of the researchable issues aimed to solve the problem. Problem diagnosis of sweet potato was carried out in Odisha, Uttar Pradesh, West Bengal and Kerala using participatory appraisal tools like key informant technique and focused group discussion. The major problems diagnosed were (i) Sweet potato is suitable for *kharif* only, difficult to cultivate in *rabi* in view of other competitive crops like potato, carrot etc. (ii) Competitive crops like vegetables are remunerative than sweet potato (iii) Lack of appropriate high yielding varieties (iv) Hybrid varieties are prone to sweet potato weevil (SPW) and (v) SPW menace, if harvested late (after 120 days). Based on the problems, 53 researchable issues were identified initially, which were subjected to judges rating for their importance, which resulted in narrowing down to 15 issues. These issues were analysed for Net Present Value (NPV), Benefit:cost Ratio (BCR), Internal Rate of Returns (IRR) and issues were prioritised as follows (i) Seasonal effects on tuberisation (ii) Germplasm collection (iii) Technology transfer (iv) Quality seed production, distribution and seed system studies (v) Stable high yield weevil tolerant varieties (vi) Integrated Pest Management (IPM) of SPW and (vii) Lowering the cost of production and (viii) Exploring exclusive value added products.

Key words: Sweet potato, problems, researchable issues, priorities

Introduction

Sweet potato, commonly known as small farmers' crop, is the second most important tropical tuber crop and is mainly grown in the countries of China, Uganda, Nigeria, Indonesia and Vietnam. It is a root crop of biological dominance in terms of its ability to generate economic returns within 3-4 months. At the same time, its social dominance in terms of livelihood security of myriad of farmers of developing countries cannot be under estimated. Sweet potato is the tuber crop, which makes its presence in many Indian states and the major states, where this crop is abundantly cultivated are Odisha, Bihar, Jharkhand, West Bengal and Uttar Pradesh. While its tubers are used mainly as vegetables in the human diet, the tubers and leaves form a good source of animal feed especially in North-Eastern India. However, of late there are many emerging evidences that sweet potato is losing its ground to other crop enterprises owing to multifaceted complex reasons especially in India,

culminating towards drastic reduction in area and production. The area, production and yield of sweet potato in India during 1986 were 1,75000 ha, 1,40,5000 t and 8 t ha^{-1} while during 2011, these were 1,13,000 ha, 10,47,000 t and 9.3 t ha^{-1} respectively. On analysis it is very much obvious that there is an unfortunate and dramatic decline in area and production and the slight increase in the productivity did not compensate for the area decline. This phenomena is observed not only in India but also in countries like China, where sweet potato was ruling among tropical tubers, now giving way for other tuber crops, like cassava.This plight speaks of volumes of strategical gaps on sweet potato research and development in India. Vitality and potentiality of this crop in the food security of small and marginal farmers could not just be ignored and overlooked and maximum advantage of this crop need to be explored through strategic R & D efforts. Among agricultural crops, tuber crops are still lagging behind in its due share in the allocation of R & D resources. The limited available resources have to be genuinely and judiciously allocated and used so as to reap the maximum benefits to the farming community. Research priority setting and monitoring have recently been introduced as research management tools to efficiently allot scarce resources to alternate choices (Joshi and Bantilan, 1997) Priority setting in research is the process of choosing between different sets of research alternatives. The aim of priority setting is to make the most effective use of available resources; its main objective is to select the best portfolio of research activities for a certain research system, institution or program (Janssen, 1995).

In order to have a need based problem oriented research programme on sweet potato, an attempt was made to diagnose the problems, setting researchable issues based on the problem and prioritisation of the researchable issues aimed to solve the problem.

Materials and Methods

There are various methods suggested for priority setting in terms of different levels from national to institute and parameters to be used. The present study followed a comprehensive approach of problem diagnosis in sweet potato organised in selected production systems of sweet potato adopting participatory approaches (Fujica, 1990). A list of 12 production systems, where sweet potato was cultivated was prepared and the same was given to a group

Table 1. Ranking of sweet potato production systems

Production systems	Ranking
Low land rainfed	1
Upland rainfed	2
Plains irrigated	3
Plains rainfed	4
Hill rainfed	5
Homestead systems	6
Upland intercropping	7
River basin	8
Low land irrigated	9
Low land intercropping	10
Upland irrigated	11
Hill irrigated	12

of 10 judges to rank the systems and the rank order of the production systems is shown in Table 1. Top five production systems were selected for problem diagnosis in sweet potato. Four states namely Odisha, Uttar Pradesh, West Bengal and Kerala, which could encompass the production systems identified, were selected for problem diagnosis.

The diagnosis was done by collecting information through participatory appraisal tools viz., key informant technique as explained by Sandoval (1990) and focussed group discussion (Rosario,1990.). Focussed group discussion was organised one each in the three districts in Odisha (Koraput, Ganjam and Denkenal), one district each in Uttar Pradesh (Sultanpur), West Bengal (Hoogly) and Kerala (Kasaragod). Key informant technique was used with two farmers each from the selected districts. The diagnosed problems were converted to researchable issues by discussing with the scientists involved in sweet potato research.The generated researchable issues were circulated to selected 30 experts on sweet potato, representing research and extension systems and were asked to judge the issues on five point rating scale namely, Very Important, Important, Neutral, Less important and Least important with scores allotted from 5 to 1 in that order. Based on the mean scores of importance, the issues were arranged in descending manner for fixing their priority and 15 issues having important score of 4 and above were selected. With the help of expert discussion the related issues were combined to form top eight researchable issues for economic assessment for further prioritisation. Net present value (NPV), Benefit:cost ratio

(BCR) and Internal rate of returns (IRR) were computed using standard procedures.

Results and Discussion

Problems diagnosed

The problems diagnosed through focussed group and key informant techniques are:

- Sweet potato is suitable for *kharif* only, difficult to cultivate in *rabi* in view of other competitive crops like potato, carrot etc.
- Competitive crops like vegetables are remunerative than sweet potato
- Lack of appropriate high yielding varieties
- Hybrid varieties are prone to sweet potato weevil (SPW) infestation
- SPW menace, if harvested late (after 120 days)
- Low yield of present varieties
- Sustainability problems of yield
- Soil fertility management
- Weed management
- Loss of sweetness within ten days of storage, especially hybrids
- Low keeping quality of tubers
- Lack of planting material of improved varieties
- Lack of knowledge on production technology
- Lack of storage technologies
- Lack of knowledge on processing technologies
- Less market demand
- Less market price
- High cost of cultivation
- High labor requirement for land preparation and interculture operations

Initial screening of researchable issues through judges rating

The 19 problems diagnosed were converted to 53 researchable issues. The mean scores obtained for the researchable issues from judges rating are shown in Table 2. There were 15 issues, whose mean scores were 4 and above. They are:

- Breeding for stable, high yield and consumer acceptance
- Breeding for sweet potato weevil tolerant varieties with higher yield
- Germplasm collection, maintenance and evaluation
- Seasonal effects on tuberisation
- Integrated pest management of sweet potato weevil
- Exploring exclusive value added products from sweet potato
- Technology transfer of improved methods of cultivation through demonstration and trials
- Lowering the cost of production of sweet potato
- Sweet potato as intercrops in cropping systems
- Production of quality planting material
- Breeding for improvement of nutritional quality
- Cost effective production enhancement of cropping systems involving sweet potato
- Development of extruded food products from sweet potato
- Development of small enterprises and processing methods for sweet potato

Table 2. Researchable issues generated based on problem diagnosed

Sl. No.	Researchable issues	Score
1.	Breeding for stable, high yield and consumer acceptance	4.54
2.	Breeding for sweet potato weevil tolerant varieties with higher yield	4.50
3.	Germplasm collection, maintenance and evaluation	4.30
4.	Seasonal effects on tuberisation	4.19
5.	Integrated pest management of SPW	4.10
6.	Exploring exclusive value added products from sweet potato	4.10
7.	Technology transfer of improved methods of cultivation through demonstration and trials	4.06
8.	Lowering the cost of production of sweet potato	4.04
9.	Sweet potato as intercrops in cropping systems	4.04

10.	Production of quality planting material	4.04
11.	Breeding for improvement in nutritional aspects	4.02
12.	Cost effective production enhancement in cropping systems involving sweet potato	4.00
13.	Production of extruded food products from sweet potato	4.00
14.	Developing small enterprises and processing methods for sweet potato	4.00
15.	Breeding varieties for value added products	4.00
16.	Breeding for drought tolerance	3.86
17.	Developing new sweet potato products for human consumption	3.86
18.	Production of audio and visual media for information dissemination	3.86
19.	Development of economic feasibility report of value addition	3.86
20.	Establishing linkage with line department for technology transfer	3.82
21.	Market system studies and demand assessment	3.80
22.	Sweet potato value added product identification	3.80
23.	Entrepreneurship development of sweet potato value addition	3.80
24.	Integrated nutrient management in sweet potato	3.78
25.	Improving the seed system (planting material distribution, regulation)	3.78
26.	Use of sweet potato plant parts as animal feed	3.73
27.	Sweet potato as intercrops in cropping systems	3.69
28.	Physiology of tuber formation and development in sweet potato	3.67
29.	Evolving sweet potato cropping systems	3.65
30.	Improving appropriate methods of communication with target audience	3.65
31.	Participatory evaluation of sweet potato varieties and production practices	3.63
32.	Improving sweet potato marketing systems and consumer demand	3.63
33.	Assessment of sweet potato technology adoption	3.60
34.	Studies on drought tolerant mechanism in sweet potato	3.58
35.	Development of labour saving interculture and weeding tools	3.58
36.	Assessment of economic rate of return for sweet potato research	3.58
37.	Sweet potato in homestead systems	3.54
38.	Standardization of technologies for fried and baked products	3.52
39.	Value chain studies of sweet potato	3.47
40.	Appropriate varieties for *rabi* season to compete with high yielding vegetable crops	3.43
41.	Handy harvesting tools for sweet potato	3.43
42.	Bio-informatics for sweet potato	3.43
43.	Development of labour saving equipment for land preparation	3.36
44.	Action research on small enterprises development in sweet potato	3.32
45.	Sweet potato growth model through computer simulation	3.28
46.	Management of intellectual property rights	3.21
47.	Investigation on alternate source of organic manures for soil fertility management in sweet potato	3.17
48.	Controlling virus diseases	3.17
49.	Breeding for shade tolerance	3.15
50.	Basic studies on sweet potato virus diseases	3.06
51.	Basic studies on pests	3.04
52.	Studies on low cost packing material for sweet potato	3.02
53.	Internet based learning modules for sweet potato technology	2.93

- Breeding varieties suited for development of value added products

Final prioritisation based on economic assessment

The 15 researchable issues were converted to eight issues (pl. see the methodology) and were subjected to economic analysis. Net present value (NPV), Benefit:cost ratio (BCR) and Internal rate of returns (IRR) were computed and the results are presented in Table. 3. Based on the NPV, the issues were prioritised, which is in the following order:

- Seasonal effects on sweet potato tuberisation
- Germplasm collection, maintenance and evaluation of tropical tuber crops
- Technology transfer studies and transfer programmes including commercialization of tuber crops technologies
- Quality seed production, distribution and seed system studies
- Stable high yield, weevil tolerant, nutrient rich sweet potato varieties
- IPM of sweet potato weevil
- Lowering the cost of production of sweet potato in various cropping systems
- Exploring exclusive value added products from sweet potato including extruded products.

It could be deciphered that the issues prioritized are essential components in sweet potato research and development in view of the problems diagnosed. Sweet potato varieties are sensitive to seasons and reasons behind it continue to be an area which could not be completely explored or answered, hence this issue becomes important and prioritized. Germplasm forms the foundation for breeding programmes and hence germplasm collection and conservation forms a prioritized issue. Likewise, issues of technology transfer, seed production and distribution are *sine qua none* for sweet potato development. Unlike cassava varieties which has well established their diffusion success, sweet potato varieties could only enjoy lukewarm reception from the farmers. This situation demands a solid sweet potato variety, which could satisfy the multi-trait needs of farmers. Of late, sweet potato crop could not compete with many vegetable crops due to its high cost of production and less profit. If sweet potato production is made cost effective, the crop has good scope in the cropping pattern of various production systems. Value addition of sweet potato in India has not taken the expected momentum and is still observed on a passive path. Hence proper value addition technological back up is required to put sweet potato on the right track. Hence the prioritization of these issues is quite logical and topical.

Conclusion

The final prioritized issues belonged to the areas of Crop Improvement, Extension and Social Sciences, Crop Production, Crop Protection and Crop Utilisation, for

Table 3. Economic assessment of the researchable issues

Sl. No.	Researchable issues	NPV	BCR	IRR (%)	Rank
1.	Seasonal effects on sweet potato tuberisation	12271	1995	160	1
2	Germplasm collection, maintenance and evaluation of tropical tuber crops	3886	39	43	2
3.	Technology transfer studies and transfer programmes including commercialization of tuber crops technologies	1507	38	4636	3
4.	Quality seed production, distribution and seed system studies	1184	3.68	136	4
5.	Stable high yield weevil tolerant nutrient rich sweet potato varieties	1005	116	55	5
6.	IPM of SPW	734	130	185	6
7.	Lowering the cost of production of sweet potato under various cropping systems	264	39.60	63	7
8.	Exploring exclusive value added products from sweet potato including extruded food products	223	24.01	39	8

carrying out the research programmes on the issues identified.The limited resources available for sweet potato research can be allocated for these issues.The research advisory and monitoring committees of tuber crops research system shall give weightages to these issues while making recommendations. The technologies generated from the research programmes would help in increasing the area under sweet potato and the productivity there by making sweet potato competitive with other crops .

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