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Adoption of Good Agricultural Practices (GAPs) in Basmati (Scented) rice: A study of prospects and retrospect

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ABSTRACT

India stands first in rice area and second in production, after China and contributes 21.5% of global rice production and faces stiff competition in the world markets for the export of scented rice. There is immense scope for India to take advantage of the new trade opportunities that sustain the export of scented rice and processed products of rice. This can be achieved only if production is made as per the consumer demands and requirements of international markets. GLOBAL GAP (earlier known as EUREPGAP) has established itself as a key reference for Good Agricultural Practices (GAPs) in the global market place, by translating consumer requirements into agricultural production and the concerns and commitments of a wide range of stakeholders about food production and security, food safety, quality and the environmental sustainability of agriculture. Besides these it has social impacts as it takes care about workers health, safety and welfare. The study conducted in Karnal and Kurukshetra districts of Haryana state on basmati rice growers showed that the awareness and the adoption of the critical GAPs in basmati production system was at lowest ebb, whereas the benefits of adoption were well understood by the farmers. Awareness level of farmers about Good Agricultural Practices in basmati rice was found to be 58.33%, whereas adoption was only 27.41% which is even less than half of awareness level. Overall preparedness for adoption of GAP was 65.67%. The farmers posed potential challenges in the form of ill preparedness for adoption of GAPs in basmati rice which need to be looked into through policy interventions and extension efforts to reinforce the adoption process.

Key words: Adoption, Awareness, Benefits, Good Agricultural Practices (GAPs), Preparedness

Over the years, the Indian agriculture has undergone several changes altering significantly its own global picture and the transformation of Indian agriculture from mere subsistence farming to commercially orient scientific crop cultivation. This self-reliance of India in the field of agriculture and its place in global agriculture had been the result of application of science in agriculture supported by conscious, sustained and meticulous planning and research efforts by the scientists along with untiring efforts of the extension workers in transferring of relevant farm technologies. However, India did not become a major exporting country for most of the crops (even premium crops) a long time and non-concern of food safety issues during the production process is one ofthe major reason. EUREGAP standards were developed by the Euro-Retailer Produce working group (EUREP) in response to consumer concerns about food safety and food quality. Standards have been developed for livestock, combinable crops, fresh fruit and vegetables, feed manufacturing and on-farm feed production and flowers and establish a baseline set of minimum standards that are widely recognised among European retailers (www.eurep.org). The Canadian On-Farm Food Safety Program (COFFS) was introduced in 1997 by the Federal government and the Canadian Federation of Agriculture, an association representing the agriculture industry. By March 2003, Canadian commodity associations had launched or were developing national on-farm food safety and quality assurance programs for their sectors encompassing GAPs. The Malaysian government has published a number of extension manuals and technology packages for various fruit and vegetable crops. Supervision and monitoring by extension officers follows an ISO 9002 system for Group Farming Extension Services. The Rainforest Alliance Better Banana project developed standards for banana production that incorporated environmental conservation goals, in addition to social goals with respect to labour conditions (FAO 2003). The supermarkets perceive that local consumers are willing to pay a premium for food safety and cleanliness assurances in the absence of effective or enforceable food safety regulations (Berdegue *et al*, 2003). Around 50% in the consumer survey indicated they might be willing to pay a

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premium for conversion-grade products to encourage more farmers to convert. Conversion-grade products appeared more acceptable among better-educated consumers and those with higher household incomes (Trantera *et al.* 2009).

The Global GAP Protocol describes essential elements and develops best practice for production of fresh agricultural produce (horticultural and all crop bases) and demonstrates a commitment and ability to produce safe and quality food, under an exhaustive system verified by an internationally recognized independent third party in order to reduce risks associated with the use of pesticides, taking into account public and occupational health, environmental and safety considerations. Besides these it is regarded as pre-farm-gate standard and has social impacts in term of workers health, safety and welfare. Price premiums are a direct and tangible revenue-based incentive for producers to adopt GAPs. They have a direct economic incentive to adopt practices that reduce their average costs of production. The dissemination of information to farmers on what constitutes a 'good agricultural practice' can help overcome market failures with respect to producer education and training in good management practices, thereby reducing costs and is a key feature of most private and public sector GAPs programmes. According to Jaffee (2003), the competitive pressure created by new and anticipated food safety standards in the EU led to significant improvements in the cost competitiveness and supply chain efficiency of the Kenyan fresh vegetable sector.

India stands first in area under rice and second in its production, after China. It contributes 21.5% of global rice production. Within the country, rice occupies one-quarter of the total cropped area, contributes about 40 to 43% of total food grain production and continues to play a vital role in the national food and livelihood security system. The importance and demand of the scented (Basmati) rice in world market is increasing day-by-day and India is facing stiff competition from Thailand, Vietnam and Pakistan for the export of rice. To enable farm produce to be internationally competitive, innovative farming practices incorporating the concept of globally accepted Good Agricultural Practices (GAPs) within the framework of commercial agricultural production for long term improvement and sustainability is important. For Farmers, there are many potential challenges and benefit in adopting GAP in almost every crop especially basmati rice as GAP norms and standards, for many of them is entirely new concept. The present study has been conducted to assess the awareness level and their preparedness for GAP along with the perceived benefits and potential challenges in adoption of GAPs basmati rice by the farmers.

MATERIALS AND METHODS

The study was conducted in the purposively selected two districts namely; Karnal and Kurukshetra district (representative of basmati rice region) of Haryana state in north India. One block from each district (Nissing from Karnal and Babain from Kurukshetra) was selected randomly. From each selected block 5 villages were selected randomly and subsequently, 15 farmers whose livelihood depends on agriculture and cultivating basmati rice were selected randomly from each villagemaking a total of 150 respondents for the study.

To measure the level of awareness 15 GAP criteria based on India gap standard for basmati rice were opted which were further divided into sub-criteria within each criteria applicable to basmati rice production system. Awareness of the respondents was measured with their responses on three point continuum of fully aware, aware and not aware at all with corresponding weightage of three, two and one, respectively, to a set of statements related to conceptual and implication domains of knowing about GAP criteria. The level of preparedness was measured on five basic requirements for GAP adoption in the form of infrastructure, financial resources, environmental, social and technological preparation. These five domains were further divided into sub domain and was measured with farmers' responses on three point continuum of fully Prepared, Prepared and Not Prepared at all with corresponding weightage of three, two and one, respectively, to a sub domain related to conceptual and implication domains of preparedness about GAP criteria. Similarly, the perceived benefits were measured on four broad heads as Farmers' benefit, Consumer benefit, Environmental benefit and National benefit. Each broad head was further divided into sub-heads as per the suitable group and was measured with responses on three point continuum of fully agree, agree and not agree at all with corresponding weightage of three, two and one respectively to a subhead. On the basis of review of litreature the potential challenges were measured as the farmers perceived challenges in terms of eight specific problems as Depletion of ground water, increased cost of cultivation, sustainability of soil, applicability to small land holding, infrastructure and machinery, finance, market potential and institutional support. Farmer ranked one to eight as perceived challenges in adoption of GAP in basmati rice production system. Garrett's ranking technique was used to find out the most significant factor which influences the respondent,As all the items were not ranked by all the respondents, the method of combining of incomplete order of merit ranking as suggested by Garrett (1979) was followed. By using this technique, the order of the merits given by the respondents was changed into ranks by using the following formula,

Percent position =100* $(R_{ij} -0.5)/N_j$

where, R_{ij} = rank given for i^{th} factor by j^{th}respondent, and N_j = number of factors ranked by j^{th}respondent. Descriptive statistics were used to analyze the data using SPSS.

RESULTS AND DISCUSSION

The results and the relevant discussion has been presented under three broad head namely; awareness level and adoption percentage of GAP in basmati rice, farmers' and system preparedness for adoption of GAP in basmati rice and perceived/ expected benefits and challenges in adoption of GAP in basmati rice by the farmers as under:

Table 1 Awareness and adoption of Good Agricultural Practices in Basmati rice (N=150)

Parameters of GAPs	Mean awareness score	Mean adoption (%)
Site history and site management	1.16	00.00
Availability of site records(flood, famine, rainfall)	1.19	00.00
Risk assessment for each site	1.00	00.00
Management plan to minimise the risk identified	1.30	00.00
Techniques to improve soil structure and to avoid compaction	1.85	20.00
Soil map of the farm - soil profile	1.34	00.00
Sowing grass or green fertilizers	2.27	23.33
Trees and bushes on borders of sites	1.94	16.67
Seed quality and health	2.24	70.22
Improved variety	2.44	100.00
Physical purity	2.64	100.00
Planting value	1.84	33.33
Seed moisture	2.22	31.33
Verification of purchased seed	2.14	80.00
Consideration of Pest and disease resistance varieties	2.15	76.67
Sowing and transplanting	2.69	74.88
Ploughing and planking	2.85	100.00
Puddling	2.94	100.00
Seed rate	2.38	93.33
Plant spacing	2.47	66.67
Mid-season drainage	2.34	33.33
Weed control	2.82	73.33
Method of sowing	2.87	86..67
Fallowing	2.56	56.67
Weeding time	2.88	64.00
Fertilizer and nutrient management	2.28	24.06
Nutrient requirements based on soil testing	1.89	13.33
Application of fertilizers/manures time interval	2.29	56.00
Fertilizer storage method	2.04	16.67
Store house separation from normal reach	2.65	9.00
Bio fertilizer and organic manure	2.54	25.33
Water and irrigation management	2.20	15.00
Pouring measured water volume	2.16	08.00
Water conservation	1.95	00.00
Hand weeding at 3-4 weeks	2.30	32.00
Record of water usage	2.82	10.00
Checking of quality of irrigation/ fertigation water	2.07	06.67
Banning of untreated sewage water	1.88	33.33
Integrated pest management	2.22	66.67
Cultural	2.30	66.67
Biological	1.55	33.33
Chemical	2.80	100.00
Plant protection products management	1.96	44.00
Choice of plant protection products	2.26	13.33
Application equipment	2.27	60.00
Disposal of surplus application mix at safer place	2.08	73..33
Pesticide residue analysis	1.17	00.00
Disposal of empty containers	2.00	73.33
Crop produce management	2.16	50.66
Harvesting process hygiene procedure	2.72	66.67
Packed produce protected from contamination	2.04	56.67
Packing material stored to avoid contamination	2.13	23.33
Waste of packing material removed	2.09	63.33
Temperature, humidity control, if stored in the farm	1.84	43.33
Crop produce handling	1.87	37.07
Hygiene risk analysis and risk assessment	1.18	00.00
Documentation of hygiene procedures implemented	1.15	00.00
Personal hygiene	1.96	56.66
Workers basic instruction in hygiene	2.00	16.67
Wearing outer garments	1.19	43.33
Smoking, eating, chewing and drinking at designated places	2.68	45.33
Clean toilet and hand washing facilities	2.54	80.00
Handling and storage area clean and maintained	2.12	42.00
Packing material stored in clean place	2.01	56.67
Restricted animal entry	1.91	30.00
Record keeping and internal self-assessment	1.59	08.57
Availability of records	1.51	00.00
Retention period defined	1.18	00.00
Workers health, safety and welfare	1.32	10.00
Written risk assessment for safe and healthy working	1.51	00.00
Basic hygiene training	1.50	00.00
Accident and emergency procedures	1.32	00.00
Protective clothing/equipment	2.60	80.00
Waste and pollutants management	1.03	00.00
Identification of waste and pollutants	1.07	00.00
Waste and pollution action plan	1.00	00.00
Environment and conservation	1.00	00.00
Management of wild life and conservation plan	1.00	00.00
Unproductive site policy	1.00	00.00
Traceability and Recall	1.04	00.00
Recall procedure to manage withdrawal	1.00	00.00
Registered product traceable back to and tractable from registered farm	1.08	00.00
Customer complaints	1.03	00.00
Complaint handling procedure	1.07	00.00
Complainant informed	1.00	00.00
Overall	1.75 (58.33%)	27.41

(*Continued*)

Table 1 (*Concluded*)

Awareness level and adoption percentage of GAPs in basmati rice

Results in Table 1 indicated that awareness and adoption was almost zero as a whole for site history and site management. Mean adoption per cent level for the technique used to improve the soil compaction was 20% which is very undesirable. Farmers were fair in choosing improved variety and checking physical purity and adoption was by 100%. In the criteria *seed quality and health* farmers were fairly aware and the fair level of adoption (70.22%). In ploughing, planking and puddling 100% farmers adopted. In sowing and transplanting mean adoption was 74.88% whereas In case of fertilizer and nutrient management farmers were almost fairly awareness but adoption percentage was very low (24%). In IPM, farmers were good especially in cultural and chemical methods and overall adoption was 66.67%. Farmers were aware about application equipments and name of plant protection products but almost not aware about pesticide residue analysis. In case of crop produce management awareness was fairly good and adoption was 55.67%. Crop produce handling of farmers were very weak in both awareness and adoption. In case of record keeping and internal self-assessment, mean awareness was low and adoption was also very less (8.57%).In case of waste and pollution management, awareness was almost zero and adoption was also zero. Criteria like environmental conservation and traceability and recall and customer complaints, the awareness was almost negligible and adoption was also zero.

The adoption of GAPs in overall was found only 27% although it is at par with the modern input intensive agriculture as reported by Pormsing (2005), whereas it was clearly demonstrated that the use of organic, GAP and chemicals can be made successfully in kale, especially these bioproducts can be used solely for organic crop and in alternative with chemicals as in GAP method and the production in all the cases was comparable. Similarly Tann *et al.* (2011) compared with organic, GAP and chemical methods in rice var. Neang Kong and Neang Kang and reported comparable yields.

The correlation with five independent variables calculated with the adoption of GAPs showed that age was found to be non-significantly correlated whereas education and mass media exposure was found to be highly correlated with adoption of GAP criteria (Table 2). Social participation and land holding were positively correlated with adoption of GAPs criterion.

Table 2 Correlation between independent variables and adoption (N-150)

Variables	r- value	t-calculated value	P value
Age	0.029^{NS}	0.353	0.724
Social participation	0.35**	4.545	0.0001
Education	0.541**	7.840	0.000
Land holding	0.266**	3.357	0.001
Mass media exposure	0.379**	4.982	0.000

** Significance at 1 per cent (α=0.01) level of significance, * significance at 5 per cent(α=0.05) level of significance, NS= Non-significant, t-table value (α=5%, n=150)= 1.9760, t-table value (α=1%, n=150)= 2.6092.

Farmers' and system preparedness for adoption of gap in basmati rice

The level of perceived preparedness measured on five broad aspects, viz Infrastructure, Financial, Environmental, Social and Technological (Table 3) showed that farmers perceived preparedness of infrastructure up to 78.6% followed by financial preparedness up to 68.3%, social preparedness up to 66%, skill and technological preparedness up to 63.3% and farm environmental preparedness up to

Table 3 Farmers' preparedness for adoption of GAP in basmati rice (N=150)

Parameters/ Sub parameters	Weighted mean score
Infrastructure	2.36
Road	2.69
Water supply	2.01
Electrical grid	2.80
Telecommunication	2.78
Marketing channel	2.48
Availability of raw material	2.20
Seed	2.36
Fertilizer	2.49
Skilled manpower	1.41
Financial	2.05
Banking	2.49
Cooperative	2.44
SHGs	1.90
Commodity specific organisations	2.13
NGOs	1.95
Subsidy	1.37
Farm environmental	1.57
Use of organic manure	1.24
Checking the methane emission from rice field	1.00
Crop rotation	2.12
Diversification	2.01
Soil fertility maintenance	1.49
Social	1.98
Social and cultural interaction	1.88
Religious and caste support	2.01
women participation	2.04
Skill and technological	1.90
Skill training facilities	1.95
Technology access	2.21
Cost of production	1.37
Expert consultation	2.09

52.3% respectively. However the preparedness in terms of sub parameters like availability of skilled manpower, SHGs presence and their activities, utilization and availability of subsidies, active NGOs involved in agricultural promotion, awareness and understanding regarding the need and methodologies for checking the methane emission from rice field, skill and technologies for reducing cost of production, lack of proper skill training facilities and less social and cultural interaction were perceived as the grey areas of preparedness. Overall preparedness was found to be 65.67% in terms of infrastructure, financial resources, environmental concern, social concern and skill and technological concerns.

Expected benefits and challenges in adoption of gap in basmati rice by the farmers

Majority of the farmers strongly agreed that adoption of GAP in basmati rice would help in development of infrastructure at field level, build up culture for GAP by farmer, increased awareness among the farmers about the need for consumption of good quality and safe food, creation of reputation in the international market as a producer of good quality and safe produce and increase in the income of farmer. However, having uniform approach across farms regardless of their sizes along with workers safety and welfare was perceived as farmers' benefit by lesser number of respondents (Table 4). From consumers' point of view it was perceived that adoption of GAP would provide quality food grains and would develop a traceability mechanism through complete integration of food chain, increased awareness about the need for consumption of good quality and safe food. It was also perceived that the mechanism will develop stakeholders' confidence in market through responsible and sustainable production.

Promotion of sustainable production and improvement in environment as well as soil fertility were among the major benefits perceived in terms of environmental benefits. For the integration into global accreditation system the value addition in the quality of farm product along with better public health through incorporation of ICM and IPM in commercial production system was the perceived benefits by majority of the farmer respondents. Weatherspoon and Reardon (2003) reported that more efficient procurement channels have enabled supermarkets to expand into poorer areas as mass merchandisers and often encourage growers in direct supply relationships to follow GAPs. Hobbs (2003) concluded that the strength of incentive is highly dependent on the ability of the marketing system to segregate GAP and non-GAP produce resulting in the catalyst for improvements to production techniques and to supply chain infrastructure (e.g. processing, storage, transportation) in developing countries. As such it may be inferred that market forces may act as drivers for the development and adoption of many GAPs through the demand by for stronger food safety and food quality assurances. Takahiro *et al.* (2014) also reported that the introduction of Good Agricultural Practices supported by government intensive training for GAP farmers has resulted in reducing environmental footprint. An elevated tendency in net income of GAP farmers was also observed, and this was because the higher farm gate price or lower production cost.

Table 4 Major benefits perceived by the farmers in adoption of GAP in basmati rice (N=150)

Perceived benefits	Mean score
Farmer benefit	2.32
Development of basic infrastructure at the field level	2.64
Build up culture for good agricultural practices by the farmers	2.65
Uniform approach across farms regardless of their sizes	1.89
Increased awareness among the farmers about the need for consumption of good quality and safe food	2.04
Worker safety and welfare	1.88
Reputation in the international market as a producer of good quality and safe produce	2.85
Increased income of farmer	2.29
Consumer benefit	2.43
Traceability through complete integration of food chain	2.82
Increased awareness among consumers about the need for consumption of good quality and safe food	2.04
Quality food grain	2.94
Confidence in market	2.04
Ensures retailers and consumers confidence through responsible and sustainable production	2.29
Environmental benefit	2.44
Promotes sustainable production	2.82
Improvement in the environment as well as soil fertility	2.54
On-farm management improvement	1.95
National benefit	2.46
Complies to the minimum standard acceptable to leading retail groups	2.30
Incorporates IPM and ICM in commercial agricultural production	2.80
Better Health of Public	2.08
Value addition of products	2.82
Integration of global accreditation system	2.30
Overall	2.41 (80.33%)

The potential challenges as perceived by farmers in terms of eight specific issues; Depletion of ground water, Increasing cost of cultivation, Sustainability of soil health , Small land holding, Infrastructure and machinery, Finance, Market and Institutional support. Farmer ranked one to eight as the perceived challenges in basmati rice production system according to their perceived level of seriousness . Garrett ranking had been used to calculate major challenges. Table 5 depicts that farmers considered depletion of ground water as first major challenge (73) followed by Sustainability of soil health (64) and Finance (57). However Infrastructure and machinery (50), Institutional support (44) and Small

Table 5 Potential challengesin adoption of GAP in basmati rice by the farmers

Perceived challenge	Percentage	Garrett value	Rank
Depletion of ground water	11.875	73	1
Increasing cost of cultivation	99.375	5	8
Sustainability of soil	24.375	64	2
Small land holding	74.375	37	6
Infrastructure and machinery	49.375	50	4
Finance	36.875	57	3
Market	86.875	28	7
Institutional support	61.875	44	5

land holding (37) were also perceived major challenges in adoption of GAP in basmati rice in the study area. Most of the reported constraints may be culminated in weak and non-prepared public extension services for favouring adoption of GAPs in some developing countries. Berdegue *et al* (2003) highlight this as a constraint to adoption of supermarket-driven GAPs in Central American countries. GAPs with built-in extension components to some extent mitigate this disincentive. Saini *et al.* (2007) viewed that all participants of the production process (from primary producers to traders) are required to comply with the guidelines voluntarily and to elaborate practical measures in order to realize them.

The poor level of awareness and adoption of GAPs in premium quality of basmati rice was found very minimal which directs inclusion of policy initiative in the direction of *economic incentives* such as increasing and stabilizing revenue, reducing average costs, improved market access, reduced vulnerability to market risks and poor agricultural practices of other farmers. The preparedness in terms of *human capital* and access to new skills, institutional infrastructures including buyer-seller relationship quality monitoring infrastructure,backward and forward institutional linkage, linkage with certification agencies, credit facilities, extension intervention in disseminating information on GAP, proper education of farmers and consumers on food safety, sustainable and ecofriendly technologies to solve pest problems in basmati rice in addition to labour saving technologies are the major issues for bringing the dream into reality regarding adoption of GAPs in basmati rice. The benefits of the adoption of GAPs are well understood by the perspective adopters but the level of awareness and the infrastructural and technological issues need to be handled in a systematic way through policy interventions in order to establish and maintain our self in international market of basmati rice.

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