



Perception of Farmers on Climate Change and its Likely Impact on Horticultural Crops

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ABSTRACT

The study was carried out by Division of Extension and Training of Indian Institute of Horticulture Research (IIHR), Bangalore during 2011-12 under National Initiative on Climate Resilient Agriculture (NICRA) project. Climate change is recognised as a major element for human and environmental crisis of the 21st century. A total of fifty farmers (respondents) benefitted with the innovative technologies to cope up with the climatic changes were selected and their experience is being encrusted. The study under taken reveals the farmers perception and opinion regarding the climate change and its impact on the horticultural crops. Further the strategies and innovative technologies that can be used for coping up of the climatic vagaries is also being mention with respect to the farmers view.

KEYWORDS : Climate change, farmers' perception, impact

INTRODUCTION

Climate change is a global phenomenon, which has local impact. Farmer is an unalienable and important stakeholder of the agriculture enterprise. So it's high time we have a look from his eyes. The change in climate likely impact on business. An understanding of climate change in his terms gives a clear picture to him in this aspect and helps him to draw a clear cut strategy. In this direction under the aegis of NICRA project the study was undertaken by Division of Extension and Training of IIHR, Bangalore during 2011-12.

Climate change is a significant and lasting change in the statistical distribution of weather patterns over periods ranging from decades to millions of years. It may be a change in average weather conditions or the distribution of events around that average (e.g., more or fewer extreme weather events). Climate change may be limited to a specific region or may occur across the whole Earth. Climate change affects agriculture, the same way Agriculture also affects climate change. Higher temperature is likely to affect many horticultural crops which need at least some minimum exposure to chilling temperature to induce a dormant stage and ready for next fruit bearing season. When temperature will rise plants need more water and there will be scarcity of water. Because there be increased evaporation from the soil and accelerated transpiration in the plants which will cause moisture stress. Likewise as night time temperature is expected to rise in near future and it will affect some crops which can't tolerate higher night time temperature. Not only night-time temperature, higher day time temperature also affects yield of crops. Higher temperature affect pollen viability too. Regarding insects-pests, they will survive more in high temperature and as a result crops needs spraying of additional insecticides and pesticides The effectiveness of pesticides will reduce at higher temperature. If temperature continues to rise then the decomposition process of soil will also increase which in turn affects soil fertility. So it's time to think about strategies to reduce the adverse impact of climate change on Horticultural crops. The report suggests some strategies like changing of cropping pattern, sowing dates, breeding improved or hybrid varieties with extreme weather tolerance etc which needs to be considered globally.

EFFECT OF CLIMATE CHANGE ON HORTICULTURAL CROPS

India with diverse agro-ecological regions provides ample opportunity

to grow a variety of horticulture crops round the year. Indian horticultural sector contributes second highest production of fruits and vegetables in the world, contributing 30.4 per cent to the country's agriculture GDP (Singh,2012). It plays a pivotal role in sustainable smallholdings, increasing employment opportunity, promoting export and above all achieving nutritional security. Since, productivity depends on the prevailing climate of the growing region, climate change and climate variability play an important role in determining the potential yields. In order to match the growing demand,not only the productivity of horticultural crops needs to be sustained but also enhanced.

In several horticultural crops high temperature leads to abnormal flower development, poor pollen production and viability, ovule abortion and reduced fruit set. High temperature reduces crop duration in many crops. In tomato fruit development is accelerated leading to lower fruit size and quality. Sex expression is affected in cucumber, high temperature increases the proportion of male flowers. Nutritional quality of fruits and vegetables depends on genetic and environmental factors and higher temperature coupled with water stress will definitely reduce the fruit and vegetable quality together with crop duration making the crop sensitive to climate change (K.S.Shivashankara *et al*, 2013). In areas where onion and chilli are grown under rain fed conditions during kharif season intermittent drought and excess moisture stress affect the productivity. Overall the increased frequency of high temperature episodes and extreme events of drought and floods affect the growth, development and quality of vegetables and fruits and alter the zones of crop adaptation. Leading to shift in agro-ecological regions suitable for growing different horticulture crops.

METHODOLOGY

The study was conducted under National innovations on Climate Resilient Agriculture (NICRA) project during 2010-11. The study areas are P.G. Hundi and Kudanahalli of Mysore district, Harathi and Mandahalli of Kolar district, Bellavi, Yedadinabele and Madivala of Malur Taluk, Devastana hosahalli of Chikkaballapura district, Nagasandra of Doddaballapura and Agrahara and Mathkur of Bangalore rural district. The selected area falls under the Agro climatic zone V, this zone receives moderate rain fall ranging from 850 to 1300 mm. The characteristic feature is receipt of torrential rains in short spell. Red clay loamy soils are the predominant soil types of the area. The respond-

ents for the study were 27 farmers from all the villages. The required data were collected from respondents using structured pretested schedules. The data collected were analyzed and tabulated using the statistical tools like percentage and mean.

RESULTS AND DISCUSSION
PERCEPTION OF FARMERS' ON RAINFALL DISTRIBUTION AND ITS EFFECT ON HORTICULTURAL CROPS

Farmers' perception findings regarding rainfall distribution and its effect on horticultural crops are presented in the Table 1. Change in rainfall pattern or distribution will have impacts on cropping patterns, availability of water and also on crop productivity. Table 1 reveals that majority (96 %) of the farmers perceived that rainfall had decreased over a period of time. This has lead to decrease in the yield of the horticultural crops as perceived by 92 percent farmers and has lead to increased and heavy incidence of pests and diseases (92 %). Due erratic rainfall distribution (62 %) the farmers observed germination failure (66 %), enormous weed incidence (96 %), crop failure (62 %) which has directed to reduced quality of produce (38 %) with occurrence of unexpected loss. Farmers also perceive that due to decreased rainfall the stagnation of water, conversion of soils to saline patches is being reduced (86%) and the nutrients loss due to leaching is also minimised (88 %).

Table 1: Perception of Farmers' on Rainfall Distribution and its Effect on Horticultural Crops (n=50)

Statements	Agree		Disagree	
	F	%	F	%
Rain fall is increasing	2	4	48	96
Rainfall pattern has become very erratic affecting crop production	31	62	19	38
Heavy incidence of pests and diseases	46	92	4	8
Failure of crops	31	62	19	38
Increased yield	4	8	46	92
Reduced quality of produce	19	38	31	62
Germination failure	33	66	17	34
More weed incidence	48	96	2	4
Stagnation of water and conversion of soils as saline patches	7	14	43	86
Unavailability of nutrients due to leaching	6	12	44	88

PERCEPTION OF FARMERS' ON TEMPERATURE DISTRIBUTION AND ITS EFFECT ON HORTICULTURAL CROPS

Temperature is one among the important factors affecting the yield and quality as the horticultural crops are more sensitive to temperature and require specific temperature for their better development. In This study majority (81 %) of the farmers opined that the temperature has increased leading to heavy incidence of pests and diseases (96 %), loss in soil moisture (89 %) that has led to germination failure (63%) and decreased yield (67%). According to the farmers the problem with unusual fluctuation in day and night was minimum (11%) thus the scorching, splitting of produce and crop loss was minimized (11%).

Table 2: Perception of Farmers' on Temperature Distribution and its Effect on Horticultural Crops (n=50)

Sl. No.	Statements	Agree		Disagree	
		F	%	F	%
1	Temperature has gone up	41	81	9	19
2	There is an unusual and wide fluctuation in day and night temperature, which is severely affecting the horticultural crops	6	11	44	89
3	Heavy incidence of pests and diseases	48	96	2	4
4	Scorching of crops	6	11	44	89
1	Splitting of the produce and loss in yield	6	11	44	89
2	Germination failure	31	63	19	37
3	Loss in soil moisture	44	89	6	11
4	Decreased yield	33	67	17	33

OPINION OF FARMERS' REGARDING CLIMATE CHANGE

As noticed earlier the effect of rainfall and temperature being the important factor of climate change and their effect on horticulture crops in Table 1 and table 2. Table 3 indicates the overall opinion of farmers regarding climate change. According to the farmers (86%) the climate change has overall increased the effect on incidence of pest and disease and increased weed infestation in the farm fields, 78 percent of farmers opine that due to decreased rainfall period, water availability is inadequate. About 70 percent of the farmers have observed increased cost of cultivation in horticulture due to high cost inputs, increased labour cost, decreased cost of returns etc and 52 percent of farmers perceive that yield and quality of the produce have decreased.

Table 3: Opinion of Farmers' Regarding Climate Change (n=50)

Sl. No.	Statements	Agree		Disagree	
		F	%	F	%
1	Increased incidence of pests and diseases	43	86	7	14
2	Decreased yield, quality etc	26	52	24	48
3	Scarce availability of water	39	78	11	22
4	Increased cost of cultivation	35	70	15	30
5	More weed infestation	43	86	7	14
6	Low income	37	74	13	26

INNOVATIVE TECHNOLOGY REQUIRED TO COPE WITH CHANGES IN CLIMATE

As studies in the earlier tables rainfall and temperature forms the major factors affecting the horticultural crops. In the study conducted under NICRA during 2010-11 some of the innovative technologies were familiarized to farmers and following observations were made through their feed back after applying the innovative technologies in their fields.

The table 4 depicts that improved cultivation practices such as mulching and drip irrigation played a very convincing role in the farmers field and almost 96 percent of the farmers agreed that the above technologies are required to cope up with change in climatic conditions together they also opine that alternate cropping pattern can also be involved to cope up with climate. About 88.89 percent of farmers have the opinion that some new innovative technologies with respect to IPM/IDM are required for effective management of pests and diseases without affecting the environment and also maintain produce quality. 74 percent of farmers opine that soil and water conservation practices like nutrient management, use of green manure crops, proper drainage facilities etc are essential to maintain the soil fertility status and also for proper water management in the prevailing situation, where water forms a scare resource. 66 percent of farmers found green house technology as more beneficial as pest and disease free crops can be grown with a bit precautionary measures, in a climate controlled situation. Also 62 percent of the farmers also perceive that subsidiary enterprises also should be followed along with farming to overcome any loss or unexpected incidence.

Table 4: Innovative Technology Required to Cope with Changes in Climate (n=50)

Sl. No.	Statements	Agree		Disagree	
		F	%	F	%
1	Improved varieties/ cultivation practices (Mulching/ Drip/ Sprinkler)	48	96	2	4
2	Alternate cropping pattern	48	96	2	4
1	Soil and water conservation practices	37	74	13	26
2	IPM/ IDM/ INM etc	44	88	6	12
3	Practicing green house technology	33	66	17	34
4	Following subsidiary enterprise	31	62	19	38

FARMERS' VIEW ON INCREASE OF PEST AND DISEASES IN THE LAST FEW YEARS

Change in the temperature and rainfall pattern has influenced the infestation of pests and diseases in the horticultural crops. Table 5 clear-

ly depicts the views of the farmers regarding the influence of climate change on pests and diseases. According to 42% of farmers there is increased infestation of thrips in the field due to climate change. As the rainfall has decreased and increased temperature has lead to hot and dry climate with low humidity which has favoured thrips infestation. 14 percent of farmers infer that fruit borer and mites has increased, 12 percent go with redmites and the rest of 4 percent of farmers opined that there was increase of lead miner, fruit fly and uji fly incidents.

With respect to the diseases 42 percent of farmers have experienced increased blight attack followed by blast as per 22 percent of the farmers. About 8 and 4 percent of farmers concern with the increased diseases like leaf spot, leaf curl, downy mildew, powdery mildew, black spot.etc.

Table 5: Farmers' View on Increase of Pest and Diseases in the Last Few Years (n=50)

Sl No.	Pest	No. of Farmers	%
1.	Thrips	21	42
2.	Fruit borer	7	14
3.	Mites	7	14
4.	Red mites	6	12
5.	Leaf minor	2	4
6.	Fruit fly	2	4
7.	Uji fly	2	4
Diseases			
1.	Blight	21	42
2.	Blast	11	22
3.	Leaf spot	4	8
4.	Leaf curl	4	8
5.	Downey mildew	2	4
7.	Powdery mildew	2	4
8.	Black spot	2	4

Table 6: Constraints and Suggestions Perceived by Farmers

Sl. No.	Crop	Constraints	Suggestions	Remarks
1.	Tomato	Pests: Fruit borer, Thrips, Mites Diseases: Late blight, Early blight, Leaf spot, Leaf curl Price fluctuation Lack of labour availability Calcium deficiency	Use of drip and mulch Following IPM, IDM & INM Use of Protray Seedlings Seed treatment with Pseudomonas Staking Use of trap crop Enrichment of FYM with trichorich Spraying of Vegetable special, Neem cake and Pongamia	50-70% increase in yield
2.	Capsicum	Pests: Thrips and mites Diseases: Powdery mildew, Downey mildew, late blight, Rust Calcium deficiency Price fluctuation Lack of labour availability It's difficult to maintain optimum temperature and relative humidity in Net house cultivation.	Growing of crops under protected cultivation. Use of drip and mulch Punning will be done at right time.	30-40 % increase in yield
3.	Water melon	Pests: Thrips, Mites and Fruit fly Diseases: Anthracnose, Rots, Watermelon bud necrosis. Fruit cracking Non availability of seeds	Use of drip and mulch Use of cucurbits fruit fly trap Enrichment of FYM with trichorich Seed treatments Use of maize as a border crop to pest and diseases Spraying of Vegetable special	50-60% increase in yield
4.	Onion	Pests: Thrips Diseases: Purple blotch, Smut, Tip drying Bolting problem in Marketing	Raised bed for seedlings Paired row system Use of Drip Seed treatments	30-35 % yield increase
5.	Ridge gourd	Pests: Fruit fly, Serpentine leaf minor Diseases: Powdery mildew, Downey mildew Shriveling and drying of small fruits	Proper pollination required Use of cucurbits fruit fly trap Use of drip and mulch Use of Pongamia and Neem soap Enrichment of FYM with trichorich	30-40 % yield increase
6.	Cucumber	Pests: Leaf minor, Mites, Thrips, White flies Diseases: Cucumber mosaic virus, Powdery mildew, Downey mildew Malformation of fruit due to improper pollination	Seed treatment with Pseudomonas Use of Protray Seedlings Enrichment of FYM with trichorich Use of drip and mulch Use of Vegetable special	30-40% yield increase
7.	Bitter gourd	Pests: Fruit fly, thrips, mites Diseases: Powdery mildew, Downey mildew, Anthracnose	Enrichment of FYM with trichorich Use of cucurbits fruit fly trap Use of Neem soap and vegetable special	50-55% yield increase

CONSTRAINTS AND SUGGESTIONS AS PERCEIVED BY THE FARMERS REGARDING CLIMATE CHANGE IN HORTICULTURAL CROPS

Table 6 briefs out the constraints and suggestions imposed by the farmers. The farmers' samples for the study from various places in Karnataka were growers of vegetables The major constraints identified by the farmers due to the fluctuation in the climatic factors are a) Incidence of pests like fruit borer, thrips, mites, fruit flies, leaf minors and white flies in solonaceous and cucurbits b) Prevalence of diseases like blight, leaf spot, leaf curl, downey and powdery mildew, anthracnose, rots, mosaic etc. c) Calcium deficiency was seen in most of the crops d) marketing problem like grading and price fluctuation was seen e) lack of labour availability f) non availability of inputs.

Following are the suggestions furnished by the farmers to cope up with the constraints faced due to climatic changes. a) Use of drip and mulch to conserve water, controlling of the humidity b) Use of green house technologies in order to grow the crops in controlled condition with less crop injury c) Following of IPM/ IDM & INM like use of trap crop, bioagents, biofertilizers, growing trap crops, fly traps etc d) Seed treatment prior to sowing to avoid soil born diseases e) Proper staking required to avoid pests and disease infestation f) Use of organic manures to retain the soil fertility g) Spraying of micro nutrients to avoid deficiencies etc are some of the expressed furnished by the farmers with regard to the climate change. Thus by following the above technologies in their fields the farmers have experienced 50-70% of yield increase in tomato, 30-40% in capsicum, 50-60% in watermelon, 30-40% in onion, ridge gourd & cucumber and 50-55% in bitter gourd.

CONCLUSION

Horticulture crop production process is a complex process, as the crops undergo series of changes due to climatic vagaries during vegetative and reproductive stages. The rise in temperature and untimely rainfall interrupts the growth and development of the horticulture crops which eventually affects their productivity, production and quality. Thus the time has come to familiarize the farmers with the innovative technologies that the research institutes have come out with and get set the farmers to challenges with the prevailing and changing environmental conditions. The knowledge base of the farmers with regard to climate change is essential and comes in long ways which serves policy makers, planners of NARS etc and help him self in chalking out strategies to cope up with climate change and its impact on Horticultural crops.

REFERENCES

Shivashankara, K.S., Srinivasa Rao, N.K., Geetha G.A., 2013 Impact of Climate Change on Fruit and Vegetable Quality, Climate-Resilient Horticulture: Adaptation and Mitigation Strategies, pp 237-244. | | Singh H.P. (2012). Adaptation and mitigation strategies for climate resilient horticulture; a key note address. In National Dialogue on Climate Resilient Horticulture, 28 & 29 January, 2012 at IIHR, Bangalore. |