Success story under RKVY Project Implemented at UAS, Raichur

SUCCESS STORY- I

Success story of Climate change Project under RKVY

1. Title: Impact of Climate Change on important crops of Hyderabad Karnataka Region

2. Category: Agriculture - Climate change and its effect on crops

3. Challenge

Agriculture is the sector most vulnerable to climate change due to its high dependence on climate and weather and because people involved in agriculture tend to be poorer compared with urban residents. More than 60 per cent of the population is directly or indirectly relying on agriculture as a source of livelihood in this region. Asian agriculture sector is already facing many problems relating to sustainability. Consistent warming trends and more frequent and intense extreme weather events such as droughts, cyclones and hailstorms have been observed across Asia and the Pacific in recent decades. To those already daunting challenges, climate change adds further pressure on agriculture adversely affecting the lives of the population particularly the poor and farmers.

Karnataka is expected to be one of the most vulnerable states to climate change. The coastal areas too are believed to be susceptible. Rainfall and temperature in the state are highly variable. The crops are generally rainfed in nature, and therefore have been at the risk of the vagaries of weather. In this gigantic situation, it is necessary that a multi-disciplinary team works under a single focused umbrella to cope up with adversities of climate change. Hence, in this direction, there was a need to take up research on response of host-plant interactions under climate change conditions which would further help to formulate feasible management strategies. These strategies could further be transferred to the well being of the farming community.

4. Initiative

The strategies mainly involved-Enrolling the farmers in the weather based Agro-services and disseminating the knowledge of daily weather data, identification and isolation of crop genotypes adaptable to climate change scenarios by utilizing available genetic resources/land races based on physiological responses, biotechnological approaches and later crop growth simulation models, studies to find out effect of climate change on insect pests and beneficial

insect (silkworm) and to assess the insect pests and diseases on real time basis so as to develop weather, climate and forecast based agro-advisories.

Keeping in mind the above strategies, the farmers were enrolled and with the help of automatic weather stations installed at the station, weather based advisories were sent through SMS to the enrolled farmers. Further, to know the responses of crops, insects, pests and diseases to the climate change; studies were undertaken on important crops of Hyderabad-Karnataka region at MARS, Raichur. The crops included *Bt* cotton, Pigeonpea and Maize which were grown in the open top chambers (OTC's) under different set of climate change treatments *viz.*, elevated CO_2 @ 550 ± 25 ppm with 2°C rise in temperature, ambient CO_2 of 390 ppm $\pm$ 25 ppm with 2°C rise in temperature, elevated CO_2 @ 550 ± 25 ppm with normal temperature, reference open top chamber and reference plot as a control outside in natural condition. Promising genotypes of the respective crops *viz.*, Jadoo and RAHH 909 in cotton, WRP-1 and Gulyal Red in Pigeonpea and DMR-54, DMR-64, DMR-27 and DMR-88 (quality protein genotypes) in maize were tested in preliminary trials to know the crop specific performance under changed climatic conditions. All the physiological growth parameters were recorded at regular intervals. Likewise, the effect of elevated CO_2 and temperature on beneficial insect (silkworm) mediated by crop was undertaken. Meanwhile insect-plant interaction studies were also carried out to know the effect of climate change on them and formulate feasible management strategies. The timeline of action of these strategies was 5 years (2012-2017), the overall amount spent was 320 lakhs and the beneficiaries include the scientists, university, policy makers and most of all- the farming community.

5. Key result/insight/interesting fact

- Weather based Agro-services in the form of SMS to farmers of the H-K region is ongoing and as of date 11731 farmers of Raichur district, 5201 farmers of Kalaburagi, 729 farmers of Bellary and 2910 farmers of Koppal totalling to 19709 farmers are getting benefitted with this service.
- Pigeon pea and Maize being a C_4 crops showed good response to elevated CO_2 (550 ppm) alone and in combination with temperature (2°C raise than normal) in terms more growth, yield and yield parameters. More yield up to 35 % increase was noticed in some genotypes of Maize while, some genotypes showed decrease in yield. In pigeonpea genotypes, 30-20 % yield increase was noticed in enriched CO_2 conditions. Biochemically, nitrogen related compounds *viz.*, leaf nitrogen, proteins, amino acids, pigments have decreased while,

carbon related compounds *viz*., leaf carbon, C: N ratio, carbohydrates, fatty acids have increased.

- Transgenic and carbon responsive (C$_3$) crop *Bt* cotton was also subjected to varied climate change treatments by selecting one variety (RAHH 909) and one private popular hybrid (Jadoo). Results revealed that growth, yield and yield parameters were more due to greater responsiveness of *Bt* cotton to CO_2 which resulted in increased photosynthetic rate leading to increased biomass. Up to 40 % yields were increased in cotton genotypes under elevated CO_2 conditions.

- The present investigations has given evidence that, climate change in the form of increased CO_2 and temperature have substantial impact on host-herbivore interactions leading to food web.

6. Impact

Weather based Agro-services in the form of SMS to farmers of the H-K region is ongoing and as of date 11731 farmers of Raichur district, 5201 farmers of Kalaburgi, 729 farmers of Bellary and 2910 farmers of Koppal totalling to 19709 farmers are getting benefitted with this service. These services have helped farmers to increase the knowledge of the farmers about the farming practices and also get real-time weather information to take up appropriate practices to increase yield and thus increase the monetary benefits.

The studies on crops have shown that, C$_3$ crops like pigeon pea and *Bt* cotton and maize being a C$_4$ crop showed good response to climate change in terms more growth, yield and yield parameters. However, C3 crops were more benefitted by enriched CO_2. Biochemically, nitrogen related compounds *viz*., leaf nitrogen, proteins, amino acids, pigments have decreased while, and the carbon related compounds *viz*., leaf carbon, C: N ratio, carbohydrates, fatty acids have increased. Hence these crops may yield more in the changed climatic situations which might be beneficiary to the farmers.

The studies on insects has given evidence that, climate change in the form of increased CO_2 and temperature have substantial impact on host-herbivore interactions leading to food web. In future climate change situations, there are risks of increase in population of some pests and with the evidence of our studies, management strategies could be planned by the farmers, scientists could plan to breed resistant genotypes and policy makers could prepare policies keeping these results in mind.

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7. Lessons Learned

Climate change is a major challenge for agriculture and food security and rural livelihoods especially in country like India where agriculture is the major occupation. Here, in our studies, we have simulated the current climatic situations with future changing climatic trends to know the impact of vagaries of climate change on food and agriculture. In our studies, we learned that the production/ productivity of crops (especially C_3 crops) increase in future climatic situation with CO_2 enrichment. Meanwhile, some of the pests and diseases may also increase in future. To overcome these challenges of climate change, the management strategies could be planned in accordance to the response of the crops and pests.

8. Supporting Quotes and Images

Overview of Open Top Chambers where studies undertaken

SCADA Room

Centre for Agro-Climatic Studies

Environmental /Plant Growth Chambers with CO_2, Temperature, Relative Humidity and Light regulation

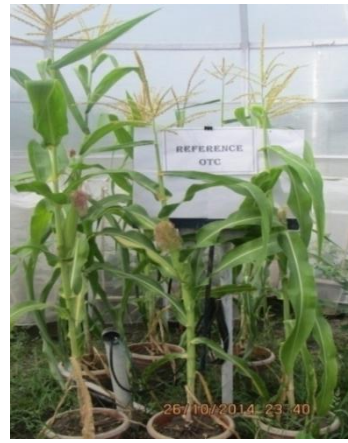**Photosynthesis system (Infrared Gas Analyser)**

Chlorophyll meter

Dualex Scientific sensor used for Leaf chlorophyll, flavonoids, Nitrogen balance index and anthocyanin measurement
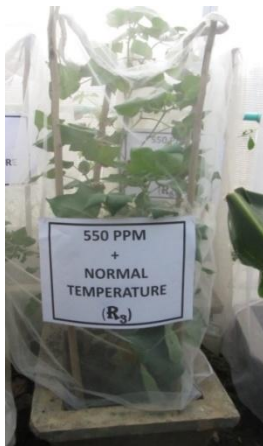

Green Seeker

Automatic Weather stations

Maize grown in Open Top chambers for climate change studies

Bt **cotton grown under OTC**

Mulberry grown in open top chambers

9. Additional information

1. List of all project partners and/or donors who supported the work

   RKVY, Bengaluru and UAS, Raichur – Not applicable to this story

2. Links to supporting materials, such as news items, photos on Flicker and presentations on Slide Share – Information available in UAS, Raichur website.

10. Checklist

Sl. No.	Question to consider	Yes	No
1	Is the story interesting to the target audience of the project/activity report?	Yes	
2	Does the story explain what new insights the project brings? What is the main lesson learned from this story? Does the story describe a key insight on what works and what doesn't and something that future project could build on	Yes	
3	Does the story describe the outcomes the project produced and the people who are benefitting? What changes–in skills, knowledge, attitude, practice, or policy–has the project brought, and who is benefitting from these changes?	Yes	
4	Does the story make a compelling point that people will remember? Does the story show how the project makes a difference to improving livelihoods and lessening poverty?	Yes	
5	Does the story provide an interesting fact that people will remember? For example, how much yields increased, how many hectares of land could become more productive from this innovation or technology?	Yes	
6	Does the story explain what kind of impact this innovation or technology could have if scaled up?	Yes	
7	Does the story show which partners contributed and how?	Yes	
8	Does the story include quotes from Stakeholders or beneficiaries?		No
9	Have I provided links to other media (journal articles, website news, newsletter, blogs, and annual reports of other Programme / project) that also feature this story?	Yes	
10	Have I provided the contact details of people who can provide more information?	Yes	

11. Contact person for this story (name, position, email address)

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