

Climate Smart Agriculture versus Climate Resilient Agriculture: A Theoretical Scrutiny

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Abstract

- The need to transform and develop our Indian farming community against climate vulnerability is felt more today. A broad and more encompassing term for enabling the agriculture sector to withstand the climate vulnerability is called as 'Climate Smart Agriculture (CSA)'.
- The development as well as advancement in the agriculture has originated either from the farming community or from the agricultural researchers. India is a country which has one of the largest and vibrant agricultural research community working for and with the farmers.
- While the global focus is on the climate smart-agriculture, the Indian agriculturist chose to focus on Climate Resilient Agriculture (CRA).
- Evidently, there is a dedicated flagship research programme - **National Initiative on Climate Resilient Agriculture (NICRA)** in 2011 to support Indian farming community against climate vulnerability. The programme is now renamed as the National Innovations in Climate Resilient Agriculture.
- Owing to the difference between the **CRA and CSA**, an introspection of the developments of NICRA will help in contemplating the hitherto contribution of Indian Agricultural Research.
- For this, the present evaluation of the scientific contribution of NICRA based on meta-analysis of the publications listed in Web of Science (WoS) and whilst bringing the difference between the climate smart agriculture (CSA) and climate resilient agriculture (CRA).
- This work also examines the climate research works of NICRA as a measure to advance our understanding on the impact of climate change in agriculture vis-à-vis technology or interventions that minimizes the impact of climate variability.

Methods

- Articles related to NICRA programme were retrieved from the WoS database using keyword search with time limit between 2010-2020
- 432 research articles and proceeding papers – analysed
- While CSA related publications from retrieved based on Rosenstock *et al.* (2018)
- Using bibliometrix R-package (Ver.1.3.959) (<http://www.bibliometrix.org>) (Aria and Cuccurullo, 2017)
- Science mapping tool – SciMAT (Science Mapping Analysis Software Tool) (v 1.1.04) was used (Cobo et al., 2012a).
- Following parameters: Unit of analysis, Words (authorRole=true, sourceRole=true, addedRole=true); Kind of network: Co-occurrence; Normalization measure: Equivalence Index; Cluster algorithm: Simple Centres (Max cluster size: 3, Min cluster size: 1); Evolution measure: Jaccard Index; Overlapping measure: Inclusion Strength.
- Publications were sorted out manually into different subject matter divisions of ICAR based on the corresponding author affiliations and two-way ANOVA was performed in SPSS (ver. 22.0)

Climate-smart agriculture (CSA)

Vs

Climate-resilient agriculture (CRA)

Concept	Climate-Smart Agriculture (CSA)	Climate-Resilient Agriculture (CRA)
Terminology	Global	Indigenous and region specific
Goal	Improving production and productivity	Ensuring production and productivity
Sustainability	In-built	Secondary focus
Technology adoption	No constraints	Constraints beyond technology availability
Investments	Can be Capital intensive	Aims to be Cost-effective
Approach	Countering the impact	Evading the impact
Foundational pillars		
i) Food security	Accessible	Ensured
ii) Adaptation	In-built	In-progress
iii) Mitigation	In-built and directly focused	Co-benefit
iv) Infrastructure	Well-built and existing	Needs improvement
Applicability		
i) Country level	Developed countries with low population pressure	Under-developed and developing countries with high population pressure
ii) Farm level	Large farmers	Small and marginal farmers
Diversification	Minimal	Maximum
Example	Precision farming	Integrated Farming

Figure 1. The total number of papers published between 2012-2020 under NICRA in WoS database.

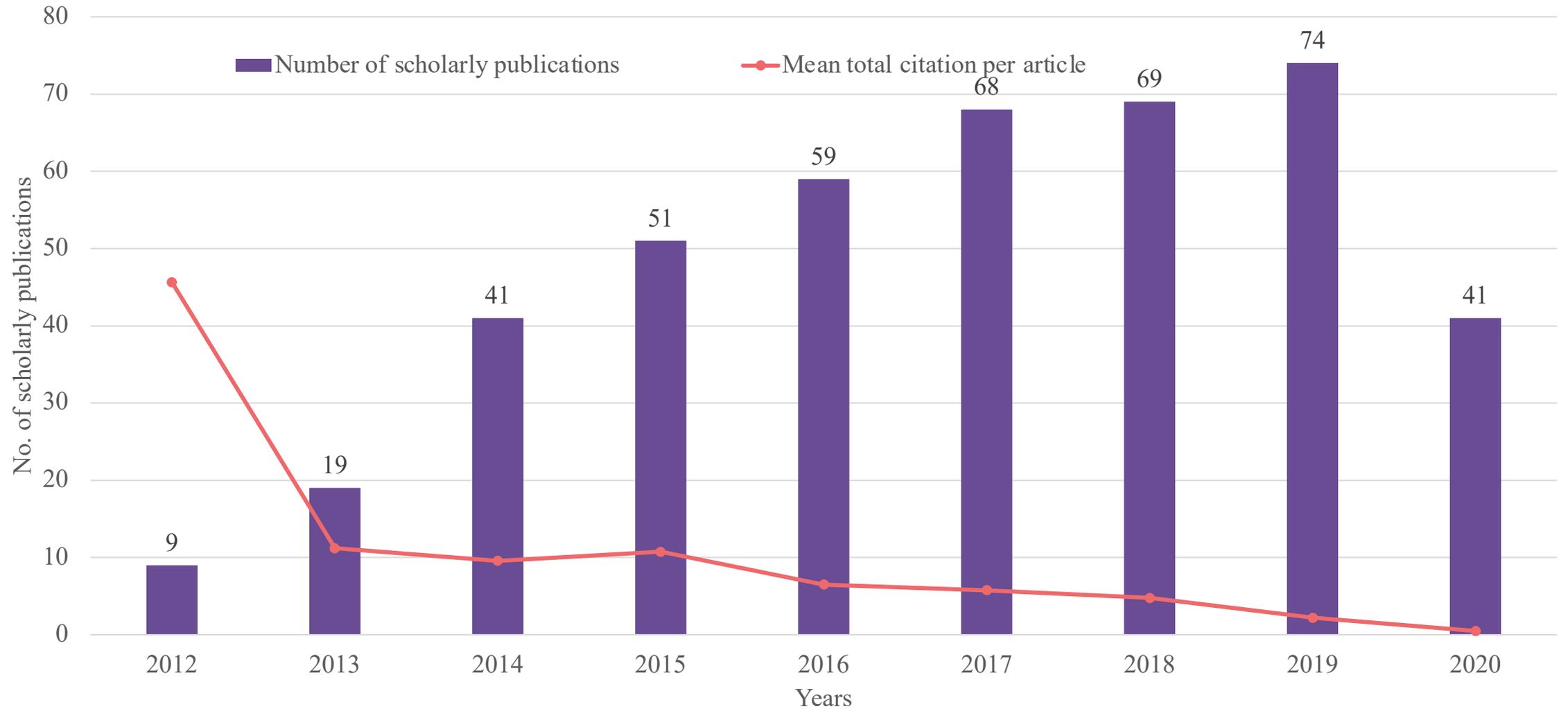


Figure 2. Prominent research themes of NICRA according to the strategic diagram

Each circular is a cluster

Overlap of clusters indicate the strong linkage between the theme

Size of the cluster indicate the veracity of research in the particular theme

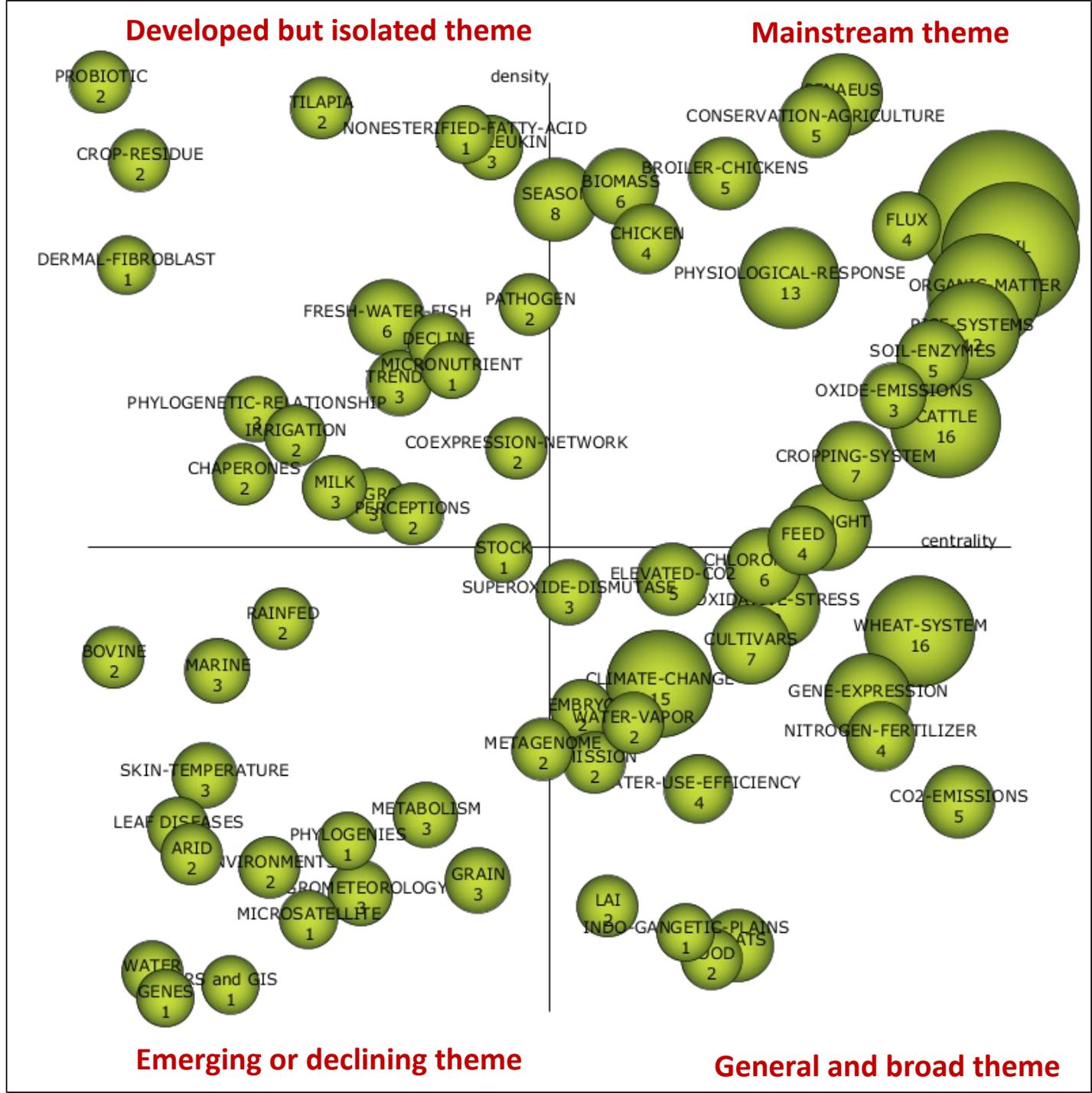
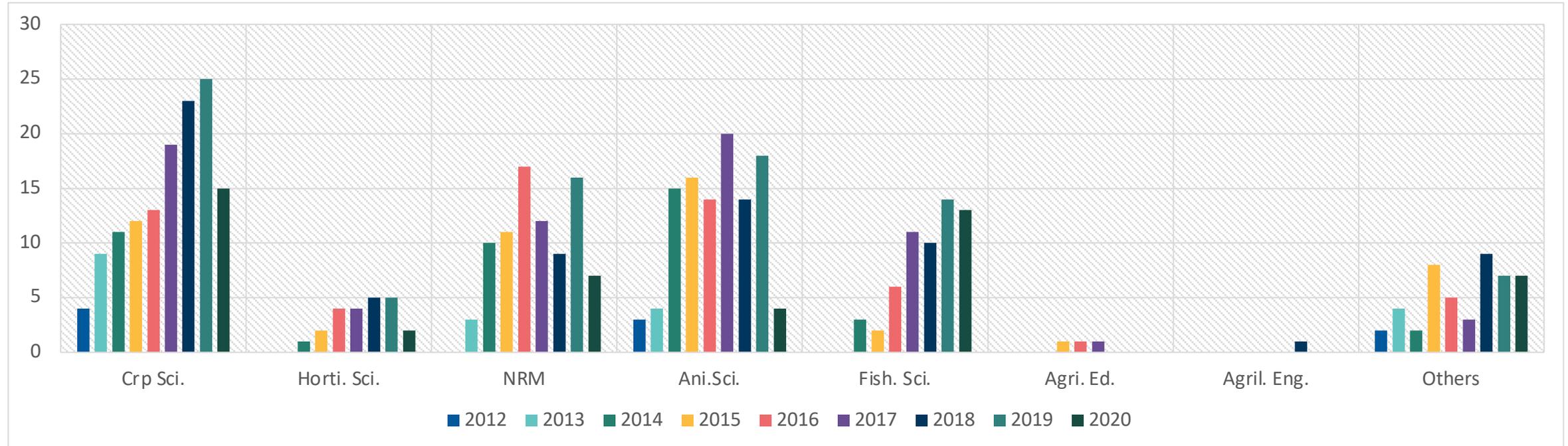


Figure 3. Research output of NICRA in terms of scholarly publications across the time in different subjects



- In India - 40 percent of papers 1965-2010 were on rice, followed by wheat (~20%) (Tripathi and Garg, 2016). Even this trends is continued as changing agricultural practice among farmers takes time
- NICRA focuses on production implication – relevance to livelihood of majority of Indian farmers and the food security of the nation.
- Similarly, for the livestock like cows, buffalo, goat and sheep plays vital role in the farm income - animal science division. Thus increased publication after 2015

Conclusion

- CRA focus initially on production and productivity through cost-effective measures where food security is the foundational pillar
- Whereas CSA focus on sustainability while food security, adaptation and mitigation are three foundational pillars
- CSA is broader and wider approach; CRA is practice and specific approach
- The crop science and animal science division has been given more emphasis because of their critical importance.
- Rice and wheat crops are the popular choices for research work.
- Bibliometrics and Science mapping are some of the reliable tools for the research performance evaluation.
- Here in this study, we can coherently visualize the scientific contribution and development of climate change research in India under NICRA

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