



## **Hans H. Ruthenberg-Graduierten-Förderpreis 2022/**

## **Hans H. Ruthenberg Award for Graduates 2022**

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### **Summary**

Stress-tolerant and improved varieties are among the main mechanisms for farmers to adapt to climate change and sustain their food production and livelihoods. However, despite their availability and promising results to improve yields, many farmers did not yet adopt the new varieties primarily because of incongruency in traits of seed varieties delivered and their preferences (mismatched targeting). When and why farmers prefer varieties are not known due to lack of understanding of their needs and systemic constraints. Our objective is to aid in designing breeding goals such that already available and yet to be developed varieties are aligned with the needs and preferences of different farmer segments. Specifically, we first characterize the marginalization experiences of different farmer segments. Next, we shed light on how farmers' preferences come about from their marginalization. We contribute to the literature by being among the first studies, to the best of our knowledge, to provide an intersectional analysis quantitatively of farmers' preferences for seed varietal traits. Many studies analyze gendered trait preferences using single sex-disaggregation or worse based on sex of household head. This approach however homogenizes the social conditions and trait preferences for all men and all women. Hence, our analysis involves a tailored approach considering not only the differences by gender but also other identity factors which others termed as gender+ such as class, caste, age, marital status, gender roles, and power/agency and their intersections with gender. We comprehensively capture the diversity of social conditions and varietal trait demands among men and women. Our overarching question is, "How do gender and other intersectionalities matter for farmers' varietal trait preferences of rice seeds?"

The thesis draws from the linkage of rational choice theory and feminist intersectionality theory. Maximizing farmers' utility will depend on how a combination of varietal traits answers their marginalized situations. Farmers' marginalization and utility are created from intersections of farmers' identity factors such as gender, class, caste inter alia, and not only based on distinct factors. This is what intersectionality argues, that identities intersect and create double or multiple marginalization to people. We conceptualize comprehensive causal loop diagrams shown in the appendix to guide our analysis and discussion. We use cross-sectional data of farmers in Bangladesh and Odisha state in India sourced from Stress-tolerant Rice for Africa

and South Asia (STRASA)<sup>1</sup> project of the International Rice Research Institute (IRRI). Bangladesh and India were chosen as they are among the top rice producers and exporters globally yet remain to have high food insecurity rates. We focus on rice due to its global importance as a food staple and source of livelihood but want to stretch that this research can apply to crop breeding in general.

Empirically, we employ a sequential multivariate analysis (i.e. principal component analysis and cluster analysis) based on identity factors and marginalization experiences in terms of time use (as proxy for gender roles), household decision-making participation (as proxy for power or agency), access to assets, markets, and information, and exposure to food insecurity and climate shocks. The motivation to cluster is to provide a segment characterization to represent a "user profile" unveiling who the different users are, how they are marginalized, their needs, constraints, and relative sizes. Per segment, rank-based quotient (RBQ) scores which have been used to quantify preferences in breeding were computed to assess the ranking patterns of farmers' trait preferences. This results in a "trait profile" summarizing the varietal trait demands of farmer segments. Thereafter, we shed light on when and why farmers demand certain variety traits. In addition, we model farmers' varietal trait preferences with similar variables used in cluster analysis. The primary aim is to see whether accounting for gender interactions and institutional factors gender roles and agency fits better compared to the usual "just" gender division as well as to support findings from the cluster analysis. The standard errors are clustered by village to account for uncontrolled variables and get robust estimates.

The cluster analysis presents five distinct farmer segments in Bangladesh and six in Odisha. Clusters are named based on farmers' intersecting identity factors given that these social positions define their marginalization experiences that thereby affect their preferences for varietal traits. In view of our research question and objectives, we present the following key findings: First, all farmer segments in Bangladesh and Odisha require good taste, which is usually a women-associated trait, besides high yield in any seed variety. Hence, future breeding programs should further understand what does good taste mean to farmers. Sensory analysis, such as participatory sensory evaluations among farmers regarding the varieties' taste, smell, texture, and overall appearance, should continue to be at the forefront of the breeding programs.

Second, contrary to usually unique preferences of men and women presented in many studies, after gender interactions, we find that both start having similar preferences when faced with identical marginalization and opportunities. In Bangladesh, men and women within high-income households (high-class) and those within low-income (low-class) households have overlapping preferred variety traits. In Odisha, while men of high-class and better-off poor and caste have similar preferences for a seed variety, young men farmers from the lowest class and lowest caste (Scheduled tribe/Scheduled Caste) have similar preferences to women farmers. In both contexts, widows show an increasing preference for agronomic and market traits of seeds which men generally prioritize. Similar preferences between gender imply that men and women withdraw from their traditional gender-associated traits. This reveals patterns that contradict the conventional narratives along gendered varietal trait preferences.

Third, the diversity of farmers' marginalization explains the plausible underlying causes associated with the varietal trait patterns. For instance, in Bangladesh, men and women farmers from poorer households have very small landholdings (<0.5 ha), which is less than half of the cultivated rice area of high-class farmers, as well as small irrigated areas. They have very low production surplus with 70% of their harvest are gone to home consumption alone, and hence

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<sup>1</sup> The project aimed to develop and deliver high-yielding rice varieties that withstand abiotic stresses to improve food security and income and alleviate poverty and hunger among resource-poor farming families and consumers in SubSaharan Africa and South Asia.

low degree of commercialization. Poorer farmers are on average 14% more food insecure and 30% more exposed to climate shocks than high-class farmers. With these, poorer farmers view rice production as for their family's subsistence. Consequently, men and women from poorer households are more likely seeking varieties that are short duration to maximize production by increasing cropping periods and ensure quicker harvest for family's subsistence. Poorer farmers prioritize seed varieties suitable for rice products as a response to their high food insecurity. They are also more likely to prefer high tillering and taller varieties as these are associated with ensuring high yield. They are more inclined to abiotic stress-tolerant varieties due to their greater exposure to climate shocks. Interestingly, men from low-class households move away from market price which is generally men-associated trait and start to prioritize easy-selling varieties as low-class women. Poorer farmers seek easy-selling to sell harvest just to make ends for the household since they have low bargaining power due to low economies of scale. On the other hand, men and women from high-class households are less marginalized and hence viewing rice production for commercial uses. This explains why high-class farmers are more likely to prefer market price and productivity-associated traits including disease-resistance and milling recovery. Thus, if breeders and other seed actors are to breed or deliver seeds to farmers, we recommend that men and women farmers of poorer households should be the focus of early-maturing, taller, flood-tolerant, and easy-selling varieties and those suitable for rice product processing because of their multiple production constraints and more exposure and vulnerability to food insecurity and climate shocks.

Widows should also be the focus of early-maturing, taller, and suitable for rice products varieties as they appear to be even more marginalized than low-class men and women married farmers, while also acknowledging their attachment to like market price and milling recovery. Widows start to prefer the latter previously men-associated traits upon their takeover of roles and decision-making of men, particularly their husbands. Shortage of family labor and challenged access to hired labor further marginalize widow farmers, thus challenging them to balance productive and reproductive roles.

Two interesting key findings in Odisha include that women segments are seen to prefer more agronomic traits including high yield and rice tillering potential and stress tolerance traits than some men groups. This indicates women's takeover of some men's roles and agency because of increasing men's outmigration in India (Pattnaik et al., 2018; Tumbe, 2015). Next, it is not only women farmers who prefer water-saving varieties but also younger men from lowest class and lowest caste households. This suggests that younger men contest traditional roles of men and start engaging in reproductive roles such as water collection, which are considered to be women's domains.

Finally, from the cluster and logit results, in Bangladesh class and marital status are social positions next to gender that drive contrasts in farmers' marginalization and have more visible effects on trait preferences. In Odisha, caste is more important than class, marital status, and age next to gender are crucial factors. This is important in scaling up a variety and technology. If we know what dimension is important, we know how to identify and target user groups specifically. Further, likelihood ratio tests indicate that simultaneously adding institutional factors gender roles and agency, which are commonly not considered in trait preference and adoption models, affect farmers' trait preferences in Bangladesh and Odisha. Further adding gender interactions in the model improves the model fit.

Farmer segment characterization and their priority traits offer practical implications to seed actors such as breeders and extension agents in developing new varieties and delivering seeds to distinct demands of farmers. It is also important for other policy-making bodies to design complementary innovations that alleviate farmers' marginalization. In view of our findings, we

further recommend that government and non-government organizations should address lack of irrigation, market remoteness, and low economies of scale as these are among the top important constraints that appear in cluster analysis. Collective action among farmers, such as cooperatives and any form of organizations must be promoted to increase economies of scale, their bargaining power (e.g. collective marketing), and share transaction costs (e.g. transport). This however will be challenging given that farmers have a very low membership in social groups based on our segmentation, hence group memberships can be a starting point. Given their low bargaining power due to a low degree of commercialization, access to information on demand and price plays a critical role. For widows, there is maybe a need to strengthen their identity and self-esteem to engage, communicate easily, and access hired labor. This again can be challenging as they currently have low membership in social groups. Self-help groups should be promoted for women, especially widows.