

Report on Participatory Varietal Selection of Amaranthus

Project: Consumption of Resilient Orphan Crops and Products for Healthier Diets

Funded by: Swissaid, India

Implemented by: DRCSC, West Bengal

Technical Partner: FiBL, Switzerland

Introduction:

Crop improvement or plant breeding is the science and as well as art of changing the traits of plants to produce desired features. The basic methods of crop improvement involve four stages viz. are domestication, introduction, hybridization and selection. In the beginning the breeding was more of art than science but now a days with technological advancement it is not only science but involves lots of technological interventions. At the beginning of 20th century, after rediscovery of Mendel's Law this branch of science took mileage. But before that crop improvement was practiced by enlightened farmers.

These farmers created large varietal diversity and also created rich, quality crops as per the requirement. This unique selection process involved both farmers' perspective as well as natural forces, which operated over a long period in their own environment. They are more locally adapted and resilient.

In the last two decades, the scientific approach of plant breeding is more explored by the public and private organizations and with technological interventions the process is hastened. Many changes occurred in the approach like beside natural variations, artificially new variation creation is possible by mutation or through hybridization. With biotechnological advancement genetic manipulation in crop is easier and selection procedure is also fast.

But over time the conventional plant breeding failed to make significant impact in vast farming areas characterized by diversity in soil, weather, crops, local farmers' needs, and farming practices. Much of the progress made in varietal improvement through conventional approach is limited to a few major crops. Moreover, in majority cases the varieties are bred under controlled condition, so may not be suitable for target production areas as Genetic X Environmental interaction has a great role to play in phenotypic expression. Again, due to introduction of released variety of the particular crop causes eradication of varietal diversity. The selection is mostly from breeder's perspective and attention is not given to farmers' need. There is little scope for effecting changes in genetic makeup of such varieties to suit local situations because of high genetic purity and seed replacement on a regular basis. So, the inbuilt capacity of coping up changed environment is lost and as result of which it loses its existence after few years.

The shortcoming of Conventional Plant Breeding as pointed out by Ceccarelli, 2012 are as follows:

1. Plant breeding has not been successful in marginal environments and for poor farmers.
2. It still takes a longtime (about 15 years) to develop and release a new variety in developing

countries.

3. Farmers adopt only few of the officially released varieties.
4. Even when new varieties are acceptable to farmers, their seeds are either not available or too expensive.
5. There is a widespread perception of a decrease of biodiversity associated with conventional plant breeding programmes.

These issues gave stimulus to think about participatory approach for crop improvement or plant breeding and development of new variety. Participatory varietal selection (PVS) is the selection by farmers on their own fields of finished or near-finished products from plant breeding programmes. These include released cultivars, varieties in advanced stages of testing, and well characterized material such as advanced non-segregating lines in inbreeding crops, or advanced populations in outbreeding crops. It is a simple way for breeders and agronomists to learn which varieties perform well on-farm and preferred by farmers. It is a both way process of research and extension method.

CROPS4HD project is working with neglected and underutilized species (NUS) which are less focused by the conventional breeders. Exploration of local diversity is the main objective in first level. For West Bengal we have selected 4 crops for participatory varietal trial viz. Green gram, Amaranthus, Lablab bean and Winged bean. Out of this in Kharif season, 2022 (May- August) DRCSC has completed Cultivar Evaluation Trial of Amaranthus. The trial was conducted in participation with farmers of Hingalganj block. Participatory Varietal Trial was conducted on 20th July, 2022. The step-by-step details methodology is described below:

Methodology:

Discussion was made with a group of 30 farmers for identification of suitable cultivar of *Amaranthus sp.* The need for selection in a participatory approach were discussed with the participants. Then following steps were followed:

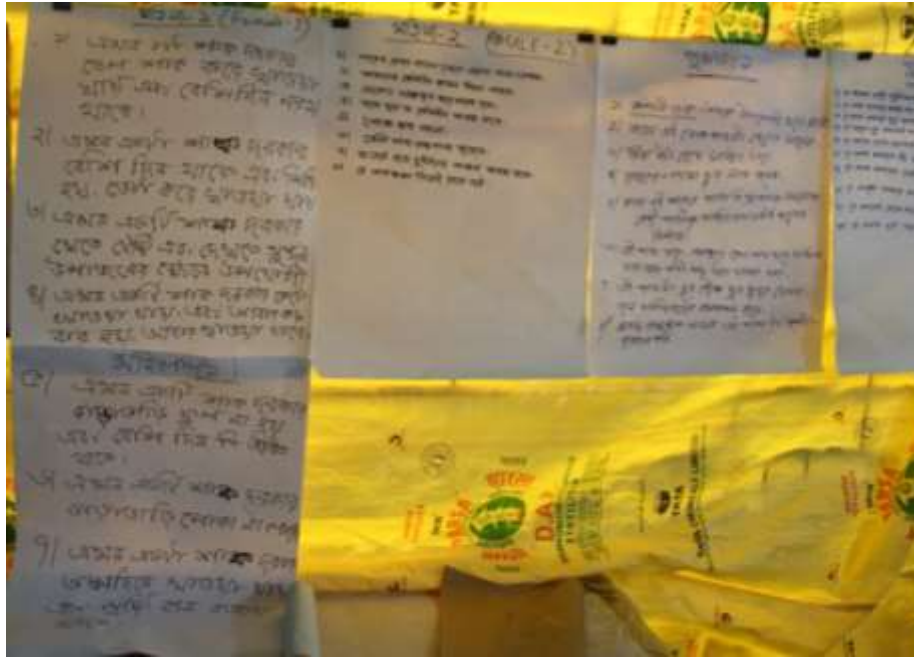
- 1. Identification of preferred trait for both gender:** A group exercise was given to the participants (separately to male and female groups). They discussed among themselves and summarized the traits they want in a suitable cultivar of Amaranthus. The male and female groups separately wrote their preference of trait for a good cultivar and they are summarized below:

Male Group:

- I. Having good nutritional value
- II. Having multiple branches/ multicut property
- III. Leaf and stem both can be eaten
- IV. Late flowering
- V. Attractive or good looking
- VI. Less attack of disease and pest
- VII. Locally adapted
- VIII. Drought and flood resistant
- IX. Seed can be kept/ produced

Female Group:

- I. Can be fried and tender
- II. Good in taste
- III. Good looking
- IV. Weather adaptability
- V. Late flowering
- VI. Less pest attacks
- VII. More branching and high growth rate
- VIII. Nutritious



<u>MALE</u>	<u>FEMALE</u>
1. Have good nutritional value (1)	1. Can be fried & tender
2. Branching / multicaul (2)	2. Good taste (1) (5)
3. Leaf and stem both can be eaten	3. Good looking
4. Late flowering (6)	4. Weather adaptability (2)
5. Attractive / Good looking (5)	5. Late flowering (6)
6. Less attack of disease/pest (3)	6. Low pest attack (3)
7. Locally Adapted	7. More branching & high growth rate (4)
8. Drought & flood resistant.	8. Nutritious (1)
9. Seed can be produced (4)	

After consulting both the groups (male and female groups) one list of preferred traits were prepared. The list is given below:

- i. Having nutritional value and good taste

- ii. Branching and multicut property
- iii. Weather adaptability
- iv. Less pest and disease attack
- v. Seed can be kept/ produced
- vi. Attractive or good looking
- vii. Late flowering

2. Field visit and tagging of cultivars: The participants were then taken to the trial plot and two different colors of tags were given to each participant (for male green and pink and for female yellow and red). They were asked to tag 5 best variety and two worst variety considering the list of traits discussed above except the first one i.e. taste and nutrition.



3. Tag counting and ranking: After visiting every plots the tags were counted and then cultivars were ranked. The list is given below:



4. **Harvesting of leaf and stem:** Amaranthus cultivars selected by the farmers with highest vote was harvested from different plots and kept separately. The leaf and stem were separated first and then measurement was taken.



5. **Evaluation of taste for preferred cultivars selected by the farmers:**

The taste of each cultivar was evaluated by male and female participants after cooking. For taste evaluation two different type of preparations were made separately with each cultivar. For leaf fried preparation was made and for stem one curry item was prepared. The participants tasted and voted for each cultivar and best cultivar was evaluated based on taste.



Result/ Outcome:

Female farmers participated tagged 12 cultivars out of 29 cultivars in CET plot as preferred cultivar and tagged 11 cultivars as not preferred. The male farmers tagged 11 cultivars as preferred and 09 cultivars as not preferred out of 29 cultivars in CET. Table 1 and 2 represents no. of participants tagged one cultivar as preferred and non-preferred cultivars.

Table 1: Cultivars selected by female participants:

Sl. No.	Preferred		Not Preferred	
	Name of Cultivar	No. of Participants selected	Name of Cultivar	No. of Participants selected
1.	IAS_021	10	IAS_022	06
2.	IAS_029	09	IAS_026	04
3.	IAS_007	09	IAS_027	03
4.	IAS_032	08	IAS_003	02
5.	IAS_011	06	IAS_017	02
6.	IAS_033	03	IAS_034	02
7.	IAS_028	03	IAS_019	01
8.	IAS_001	03	IAS_031	01
9.	IAS_302	03	IAS_032	01
10.	IAS_009	02	IAS_016	01
11.	IAS_035	01	IAS_005	01
12.	IAS_015	01		

Table 2: Cultivars selected by male participants:

Sl. No.	Preferred		Not preferred	
	Name of Cultivar	No. of Participants selected	Name of Cultivar	No. of Participants selected
1.	IAS_032	13	IAS_017	05
2.	IAS_007	09	IAS_015	04
3.	IAS_029	09	IAS_022	03
4.	IAS_002	07	IAS_026	03
5.	IAS_011	07	IAS_031	02
6.	IAS_302	03	IAS_034	02
7.	IAS_005	03	IAS_008	02
8.	IAS_033	03	IAS_016	01
9.	IAS_021	03	IAS_301	01
10.	IAS_022	01		
11.	IAS_001	01		

Maximum number of participants (21) selected IAS_032 as their preferred cultivar where as IAS_007 and IAS_029 was selected by 18 participants as their preferred cultivar. 13 participants selected IAS_011 and IAS_021 as their preferred cultivar of Amaranthus (Fig 1).

IAS_017 and IAS_026 was tagged by 07 farmers as their non-preferred variety and IAS_015 and IAS_034 was selected by 04 farmers as non-preferred variety (Fig 2)

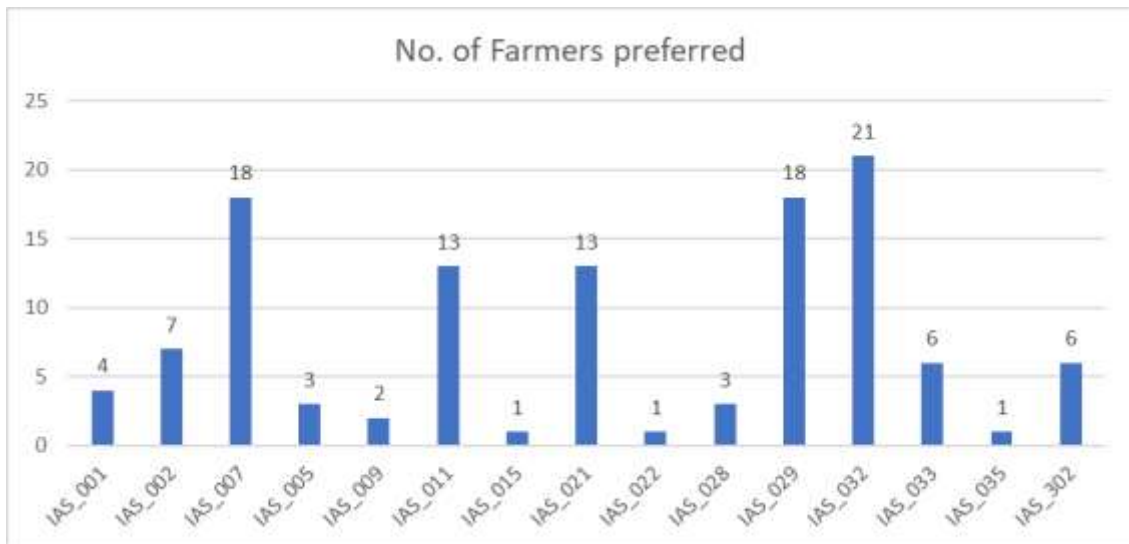


Fig 1. Bar diagram representing number of farmers preferred different Amaranthus cultivar

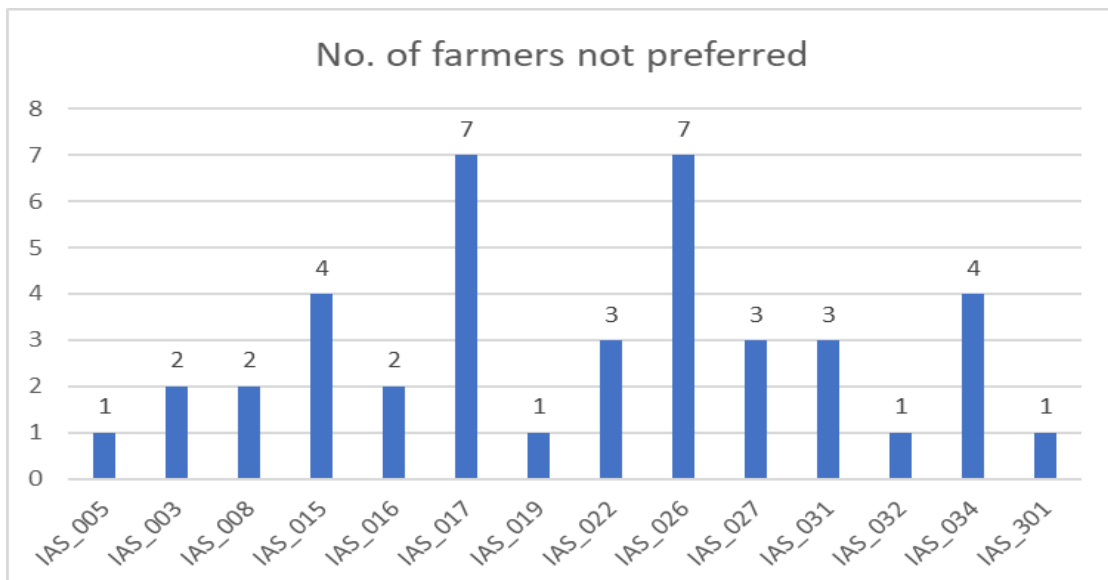


Fig 2. Bar diagram representing no. of farmers not preferred different Amaranthus cultivar

When taste parameter was evaluated the most liked variety for **leaf Amaranthus was IAS_002 Billi Rajagiri from Karnataka) and IAS_029 (Chhatrobhango from West Bengal)** and for **stem Amaranthus it was IAS_007 (Red Amaranthus from West Bengal) and IAS_032 (Altapati from West Bengal).**

Participants gave opinion that all the varieties are tasty and would like to take but the above-mentioned varieties tasted best.

Conclusion: Participatory Varietal Trial of Amaranthus in CET plot at Hingaljanj showed that two Amaranthus cultivar viz. IAS_029 and IAS_002 has potential as leaf Amaranthus in that region as farmers preferred them mostly and IAS_007 and IAS_032 has potential for stem Amaranthus.

Further trials and evaluation are needed.