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Research Article

Establishment of Crop Cafeteria for Initial Testing of Crops and Varieties in Acidic Soils of Meghalaya Under Organic Production System

Amit A Shahane* and UK Behera

Department of Agronomy, College of Agriculture (CAU-I), Kyrdemkulai, Meghalaya, India

***Corresponding Author:** Amit A Shahane, Department of Agronomy, College of Agriculture (CAU-I), Kyrdemkulai, Meghalaya, India.

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Abstract

The crop cafeteria for rabi season crops was established at College of Agriculture, Kyrdemkulai, Meghalaya in December 2020. The objective is to introduce the students to different agronomic crops and study the suitability of new crops and varieties in Meghalaya state. The different varieties of field pea, chickpea, lentil, french bean, sunflower, safflower, green gram, black gram, wheat, linseed, groundnut, soybean and horse gram were sown in crop cafeteria. In total, 40 plots of dimension of 2 × 2 m were prepared and in each plot; lime and poultry manure were applied @2.5 and 5 t/ha respectively. The seeds of the crops were collected from ICAR-Indian Institute of Pulse Research, Kanpur and seed of local varieties grown in western Maharashtra arid zone of Maharashtra state. The sowing of the cops was done at uniform spacing of 30 × 5 cm spacing. Result showed that, grain yield of field pea, french bean and lentil varies from 425 - 1225 kg/ha, 95-392 kg/ha and 112-160 kg/ha, respectively. The chickpea yield varies from 47-170 kg/ha with IPCK 2004-29, IPC-2004-978, IPC-2005-62 and DCP-92-3 varieties indicating poor performance of chickpea. Both the wheat varieties (HD-2189 and Lok-1) grow very well with grain yield of 2002 to 2582.5 kg/ha. In nutshell, timely sowing, maintaining optimum plant population, in-season nutrient management and addition of crop residue as mulch for conserving water are important operation need to be conducted in rabi season for successfully establishing crop cafeteria.

Keywords: Northeast Hill region; Chickpea; Field Pea; Lentil

Introduction

The establishment of crop cafeteria involves growing of different crops and their varieties to study of morphology of crops, varietal difference, yield performance and stress. The crop cafeteria also serves an avenue for identifying potential of crops and varieties in new area and to study the different biotic stresses affecting crop performance in new area and their identification such as weed, insect-pest and diseases [1,2]. The crop cafeteria will also serve the purpose of learning the crop input management and their significance in influencing the crop growth and yield to graduate students. The measurement of growth and yield attributes of different crops is basic of any agronomical experiment [3] and crop cafeteria provides opportunity to learn these measurements at graduation level.

Besides the academic significance, the cafeteria also has scientific and extension significance. The scientific significance is indicated by increase need of searching the non-conventional area for different crops as a result of changing climatic conditions. The shift in crop cultivation zone is one of the recommended practices for adaptation to climate change. This is more relevant for arable crops as they are more vulnerable to climate change [4-6]. This can be clear from reports of significant decrease in productivity of crops due to climate change [7,8]. The information generated in such crop cafeteria will be serving as input for further changes in input and management practices for newly introduced crop [9] as well as adoptability of these crops in new environment [10]. The extension significance is indicated by demonstration of crop and their new varieties to stake holders to bring the scientific improvements in their vision. The significance of crop cafeteria as avenue for demonstration of varieties of different crops and technologies was also reported by Singh., *et al.* [11]. These extension activities help in increasing the testing of crops and new varieties in real field situations with traditional practices.

The crop cafeteria in state such as Meghalaya is having special significance due to different agro-climatic condition than conventional zone of arable crop cultivation (plain area). The state

of Meghalaya is known for its diversity with respect to altitude, land topography, rainfall and area coverage under forest. The major crops grown were rice (13. 6% of total cultivated area) and maize (1.32% area out of total cultivated area); while crops such as wheat, chickpea, pigeonpea, jute, mesta, cotton, sugarcane, soybean, linseed, mustard and rape seed, sesame and castor are grown on piece mill basis. The agrarian population account 81% and arable crop production in state is known for higher soil organic matter content (80% area in Meghalaya have > 1.% SOC) [12], organic production system progress (10.8 time increase in organic area from 2014-15 to 2018-19; Total area: 48,409 ha in 2018-19) [13], variation in land configuration (raises and sunken beds, puddled rice paddies, upland non-puddled cultivation), *Jhoom* cultivation, acidic soil with seasonal changes in soil pH and high rainfall (3784 mm/annum with 21% CV) [14]. As the agriculture in Meghalaya is dominated by organic production process, it remains unaffected by modern agrochemical based agriculture and still dominated by useful indigenous knowledge. In such condition, introduction and study of new crops and varieties are scientifically sound.

Materials and Methods

The seed of *rabi* season crops grown in crop cafeteria were collected from ICAR- Indian Institute of Pulse Research, Kanpur and local seeds from Maharashtra. The seed were received in small quantity hence small area of 2 × 2 m was selected for sowing individual crop and their varieties. The field was previously planted with rice and after harvesting of rice, field was prepared by loosening of soil manually with spade and hand hoes. The field was divided in to 40 plots with dimensions of 2 × 2 m. In total 40 crops/varieties were grown (Table 1 and Figure 1). The field was amended with 2.5 t ha^{-1} lime and 5 t ha^{-1} poultry manure uniformly in all plots and mixed well in the soil before sowing. The sowing of crop was done at uniform spacing of 30 × 5 cm for all crops and quantity of seed used for each crop/variety was given in table 1. As the planting was done late in the month of December the crop faced the water stress and irrigation was applied 2-3 times in a week. Field was weeded once at 25 to 30 days after sowing and no plant protection measures were taken. The crops were harvested manually starting from last week of March to first fortnight of April 2021 and threshed after drying manually due to less crop produce.

Results and Discussion

All the varieties of field pea grow profusely in vegetative phase; while after flowering stage, the growth was sluggish and pod filling was poor in all the pea varieties (Table 1). The nutrient stress, non-adaptability of varieties in acidic soil, late plating condition and terminal high temperature may be the possible reason for the same [15]. All the four lentil varieties had 100% germination and grew very well. The flowering and pod formation was normal;

Figure 1: View of crop cafeteria.

while number of seeds per pod and size of seed was very less in all varieties. The sunflower variety DRSH-1 did not germinated; while local sunflower seed showed the optimum germination and grew well. The drying of leaves, lower height, thin stem and small diameter of capitulum are the abnormal symptoms shown by the sunflower plants. The groundnut takes more than month to germinate and germination is sparse. The seeds sown remain in healthy condition for more than two months and even after one and half month seeds were germinated. The flowering in groundnut started second fortnight of March. This indicates that groundnut can be significantly grown in spring season [16] and will be considered for further study. The local variety of linseed grew very profusely with 3-4 branches per plant and had numerous seed boll. The height of crop was restricted to 30- 45 cm as the seed sown were local varieties grown in western Maharashtra arid zone.

The Local variety of soybean did not germinate which might be due to late sowing [17]; while in case of horse gram (*Macrotyloma uniflorum*), germination is 100%. The growth of horse gram is very poor and crop remains at 4-5 cm height in first month and 8-12 cm even after 90 to 100 days. This indicates non-suitability of crop/variety if sown in the month of December or if sown in the acidic soil. Further study of varietal performance in small plots in cafeteria or in pots is needed to confirm the findings. Both wheat varieties (HD-2189 and Lok-1) grew normally with height varies from 85 to 98 cm. The grain filling was lower in Local (HD 2189) variety. At the same time, termite infestation [18] was more starting from panicle emergence and ponding of water after every two days was done for their management (due to light soil water get drained away quickly). In case of green gram and black gram, germination was optimum while the growth above coteledonary leaves was very shy and restricted. The plants were drier and withered out. Among three varieties of french bean, the growth of Arun was found better

Sl. No.	Name of crop	Name of variety	Source of seeds	Seed sown in each plot (grams)	Grain yield (grams per plot)	Stover yield (grams per plot)	Grain yield (kg/ha)	Stover yield (kg/ha)
1	Chickpea	IPCK 2002-29	ICAR-IIPR, Kanpur	35.2	4	93	10	232.5
2		IPCK 2004-29		35.2	68	47	170	117.5
3		IPC-2004-1		35.2	2	58	5	145
4		IPC-2004-978		35.2	19	180	47.5	450
5		IPC-2005-62		35.2	64	510	160	1275
6		DCP-92-3		35.2	68	320	170	800
7	Green Gram#	IPM 99-125	ICAR-IIPR, Kanpur	13.2	-	-	-	-
8		Local	Local seeds from Solapur, Maharashtra	13.2	-	-	-	-
9	Safflower#	ISF-764	ICAR-IIPR, Kanpur	5.28	-	-	-	-
10		DSH-185		5.28	-	-	-	-
11	French bean	Arun	ICAR-IIPR, Kanpur	28.6	157	100*	392.5	250
12		Uttkarsh		28.6	38	20*	95	50
13		Uday		28.6	122	58*	305	145
14	Black gram	IPU 13-1	ICAR-IIPR, Kanpur	13.2	-	-	-	-
15		IPU 94-1		13.2	-	-	-	-
16		IPU 11-02		13.2	-	-	-	-
17		Local	Local seeds from Solapur, Maharashtra	13.2	-	-	-	-
18	Wheat	Local (HD 2189)	Local seeds from Solapur, Maharashtra	44	1033		2582.5	-
19		Local (Lok-1)		44	801		2002.5	-
20	Sunflower	DRSH-1	ICAR-IIPR, Kanpur	5.28	-	-	-	-
21		Local	Local seeds from Solapur, Maharashtra	5.28	22	646	55	1615
22	Lentil	DP 1-15	ICAR-IIPR, Kanpur	13.2	45	151	112.5	377.5
23		IPL-315		13.2	65	110	162.5	275
24		IPL-321		13.2	64	128	160	320
25		IPL-534		13.2	60	100	150	250
26	Groundnut#	Local	Local seeds from Solapur, Maharashtra	44	-	-	-	-
27	Horse gram#	local	Solapur, Maharashtra	11	-	-	-	-
28	Linseed#	Local	Solapur, Maharashtra	13.2	-	-	-	-
29	Soybean#	Local	Solapur, Maharashtra	30.8	-	-	-	-
30	Black gram#	IPU 10-26	ICAR-IIPR, Kanpur	13.2	-	-	-	-
31	Field pea	IPFD 12-2	ICAR-IIPR, Kanpur	35.2	-	-	-	-
32		IPFD 09-2		35.2	240	2540	600	6350
33		IPFD-14-2		35.2	490	2050	1225	5125
34		IPFD-01-10		35.2	290	1580	725	3950
35		IPFD 10-12		35.2	200	1080	500	2700
36		IPFD 06-3		35.2	340	2370	850	5925
37		IPFD 99-13		35.2	340	2250	850	5625
38		IPFD 11-5		35.2	170	1100	425	2750
39		IPF-99-25		35.2	200	1230	500	3075
40		IPF-05-19		35.2	320	1550	800	3875

Table 1: Details of crop growth performance in crop cafeteria during *rabi* season of 2020-21.

#: crops were not harvested due to drying of crop before harvesting (green gram and black gram), rottening of seed in seed bolls due to pre-season rainfall (safflower and linseed), no germination (Soybean and sunflower).

*: Weight of empty pods.

with yield of 392.5 kg/ha. In all the three varieties, establishment of first two rows located at the higher elevation in the plot was very poor indicating the role of land slope and need of land configuration study for frenchbean [19]. The safflower plant grew very profusely with the height varies from 105 to 125 cm; while tip drying was observed even after sufficient watering in both varieties and crop remain in vegetative stage without having a single flower. The flowering start very late (in Month of May) and due to pre-season rainfall the harvesting become difficult and rottening of seed boll take place.

In chickpea, three varieties viz., DCP-92-3, IPC-2005-62 and IPCK-2004-29 grew optimally covering the entire land; while other varieties (IPCK-2002-29, IPC-2004-1 and IPC-2004-978) remained without branching. All plots grown with chickpea were fertilized equally and optimally and are on same land topography (elevation and slope), hence role of soil fertility is not expected in the variation in growth of chickpea. This indicates the varietal response of chickpea in acidic soil in organic production system [20].

Conclusion

The performance of different crops and their varieties remain suboptimal which was driven by variation in sowing time, in-season nutrient stress, soil reaction and newness of crops and varieties to agro-climatic conditions. The varietal trails for crops such as wheat, field pea, french bean, chickpea and linseed will be having promise in acidic soil of Meghalaya; while testing crops such as safflower, sunflower and groundnut in time dimension will be worthy.

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Conflict of Interest

Author declares no conflict of interest.

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