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Full Length Research Paper

Small-millet seed production that involves tribal farmers in the Bastar region of Chhattisgarh, India

Sanjay and Krishna

Research MATS University, Raipur, Chhattisgarh, India

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The Because little millets can withstand water stress, drought, and erosion, they may be a better choice in areas with unpredictable rainfall and dry conditions where rice and other crops frequently fail. There were several upland areas in this area that might be used for small-scale millets production if farmers participated in a seed production program to improve their economic situation. To increase production, settlements with basic technology support were divided into ten clusters. With the introduction of improved varieties, line sowing, weed control, and nutrient management as a rain-fed system, the average productivity of tiny millets increased from 4.00 to 20 q/ha.

Key words: Front line demonstration, Small millets, Seed production, Participatory mode.

INTRODUCTION

The With a total size of 8755.79 km2, Bastar District is located in southern Chhattisgarh. The district headquarters are located in Jagdalpur. More than 65% of the district's 1,411,644 residents, or about the same as the US state of Hawaii or the country of Swaziland, are members of tribes including the Maria, Muriya, Bhatra, Halba, Gond, Parja, and Dhurva, according to the 2011 census. There are 140 people living in the district per square kilometer. In the Bastar region of Chhattisgarh, rice is primarily farmed as a rain-fed crop over 2.39 lakh hectares during the kharif season, although its production is a pitiful 8.53 q/ha. While just 1.2% of the land is irrigated, and only 1.67% of the land is irrigated, very little fertilizer (4.6 kg/ha) is used, which is not enough to provide enough nutrients to the crops that are in high demand. Traditional farming methods continue to determine Bastar's pattern of subsistence. While there are very few iron ploughs, the use of wooden ploughs is overwhelming. The same is true with cattle carts; tractors are quite rare, although bullock carts are widely used. The production of agriculture has decreased due to the use of traditional agricultural tools. Paddy, tiny millets, horse gram, urd, arhar, jowar, and maize are the kharif crops cultivated here. Only small millets can be grown in such circumstances because of their eating habits and farming methods, which state that rice cannot function well in unpredictable rainfall and occasionally fails entirely because of this factor. However, small millets may be a suitable solution because they require less rain than rice and are more drought-tolerant and erosion-resistant. There is a lot of highland land in this area that might be used for small millets' seed production during kharif.

This concept was kept in mind in inception of seed production programme

Figure 1. Weed management by intercultural operation in kodo millet.

Since the weeds were competing with the crops for the first 15 to 30 days, they would be appropriately handled using both mechanical and manual methods. However, manual weeding is more expensive

Figure 2. Contingency crop planning by gap filling.

so that farmers can get handsome returns.

METHODOLOGY

According to the farmers who grew small millets, the targeted villages were divided into ten clusters, which included: cluster 1: Bastanar, cluster 2: Turenar, cluster 3: Tokapal, cluster 4: Kumari, cluster 5: Chitrakote, cluster 6: Dharmaur, cluster 7: Narayanpur, cluster 8: Bakawand, cluster 9: Dantewada, and cluster 10: Mendri. The technologies provided to each cluster included improved versus local land race varieties, crop establishment techniques (line sowing versus broadcasting), weed control (mechanical and herbicidal versus control), and nutrition (nitrogen, phosphorus, and potash). Two groups were created following site and farmer selection because grain production included truth label seed or below grade on farmers' fields for consumption and market sale, while seed production included foundation and certified seed production (Samui et al., 2000). The cost of cultivation, gross income, net income, benefit-cost ratio, and the area covered by upland clusters in the past and present were all examined based on farmers' investment. In order to formulate research and extension works, the following procedures were taken:

Step I: Replace the current local landraces with improved cultivars while maintaining the other agronomic practices they had previously used, such as seed broadcasting, no weeding, and no nutrient management. Due to the apparent increase in yield and the potential to employ new agro-techniques for adoption and incentive, this replacement forced the farmers to embrace the new intervention.

Step II: The demonstration of line sowing with a seed drill was another significant invention. The lack of appropriate tools for little millets caused issues with line sowing; traditional agricultural tools were primarily utilized. A bamboo-based Nari plow installed in a rural plough with a plastic funnel into which only seeds were thrown was the first solution to this problem. In the broadcasting approach, rainfed upland rice is often sown during a shorter window of time than small millets, and millets are the subsequent crops. Today's unpredictable rainfall forced them to switch to upland crops in such a harsh environment. In the following years, the development of the seed-cum-fertilizer drill (bullock drawn) and its demonstration on a farmer's field in front of fifty farmers sparked this, making it very easy for farmers to embrace line sowing methods in tiny millets over rice. This time, fertilizer was applied in rows and seeds were sown. However, it wasn't until the tractor-drawn drill was introduced in the following years that enormous areas were covered (Figure 8).

Step III: The uplands were nearly completely covered by aerobic farming, which gave the weeds a variety of growing conditions. because of the labor involved. Summer plowing decreased the weeds by up to 60%, and the residual weeds were controlled by using 0.5 kg/ha of isoproturon and oxyflourfen as pre-emergence treatments. Lines were kept 30 cm apart, and a desi plough (also known as a bushening plough) was employed to control weeds. The ploughs are small enough to run between rows, and they also aerated root zones, loosened the soil profile, and suppressed weeds. Following the use of line sowing techniques, which proved successful in weed management, these methods were used to suppress weeds up to 70% while producing a greater yield (Figure 4).

Step IV: Tribal communities rely on small millets as a source of income, but the introduction of commercial crops to the uplands reduced the area covered in this region. The region was still experiencing severe crop declines, but this was addressed in 2003 as part of the AICSMIP in an effort to increase coverage over the uplands. Farmers were initially given inputs in the form of seeds, fertilizer, and techniques, but they eventually adopted the practice and began using their own inputs; as a result, small-scale millets are now grown on the same plot of land where upland rice is no longer as productive.

Step V: Farmers were encouraged to produce high-quality seed on their own properties by the adoption of new technology. Farmers are adopting and earning more money from the foundation and certified seed of ragi (finger millet), kodo millet, and small millet than from the manufacture of truth label (T/L) seeds. Following registration, they are guaranteed the opportunity to plant little millets by lifting seeds. Because it is a pocket-specific crop that can only be cultivated in a specific area of the country, the high-quality seed production also helped the Seed Certification Corporation. This time, fertilizer was applied in rows and seeds were sown. However, it wasn't until the tractor-drawn drill was introduced in the following years that enormous areas were covered (Figure 8).

RESULTS AND DISCUSSION

Entry of new cultivars

New varieties (Table 1) have their own dimension but

Table 1. Varieties performed under farmers' field with improved technologies in last ten years.

S/N	Crop	Varieties	Liking feature	Area coverage (acre)	Yield potential (q/ha)	Increased % over local
1	Finger millet	GPU 28	High yielding, rain fed cultivar, long open finger	600	20-30	200
		VR 708,	High yielding, suited for stress condition	300	20-25	175
		Rantagiri	High yielding, Short stature, medium finger	200	18-20	150
		VL 149	High yielding, Pigmented finger	120	15-20	140
		PR 202	High yielding, tolerant to blast	100	15-18	135
2	Kodo millet	RBK 155	Regular raceme, compact grains, more productive	400	18-25	150
		JK 48	More tillers, lodging tolerant, high yielding	250	15-20	140
3	Little millet	JK 8	High yielding, lax panicle	200	5-8	200
		BG 1	Medium height, synchronized maturity	120	4-6	180

with the time and requirement changed the potentiality. By introducing new cultivars over current localities, agronomical demand for cultivars could be fine-tuned to result in higher production. Over the past ten years, demonstration fields have seen a 200% increase in output. Given the demand for 100 to 500 quintals of seed annually, producing high-quality seed (both foundation and certified) on farmers' fields may soon be a means of generating income.

Refined technologies

Because previous methods were not in line with the rate of production, traditional technologies must be improved to meet current demands (Mokidue et al., 2011). The conventional plough, which is still in use in isolated places, needs new bullock-drawn tools and the best possible mechanization. Therefore, it is imperative to improve the current methods. Crop establishment and seed broadcasting caused weeding issues, which may be resolved by line sowing, which offered effective mechanical weed control techniques (mechanical, herbicidal, and IWM) in between rows (Figure 4 and 9).

Nutrient management

When the program was being planned, fewer farmers were applying fertilizer to upland areas, which drastically reduced the potential yield because the soil's available nutrients were being depleted without adequate management of both major and secondary nutrients. Line sowing can be used in place of broadcasting, and the timing of sowing (moving the monsoon from mid-June to mid-July) is also controlled according to the early or late advent of the monsoon, which improves success over typical system failures (Hiremath and Nagaraju, 2010). By arranging fertilizers in rows, line sowing paved the path for nitrogen management and increased output during the crucial demand period shown in Tables 2 to 4 and Figures 5 and 6.

Mechanization

It was necessary to increase the area under cultivation for small millets, and this was accomplished by mechanization. In a similar vein, the implementation of better methods and the reduction of drudgery in sowing with the use of seed and fertilizer drills increased the potential yield while also reducing labor participation due to a labor shortage. Implements drawn by bullocks and tractors were introduced in response to farmer needs (Figure 10). In ten years, at least half of the adopted farmers, who now share the implements during the cropping season in the same cluster, undoubtedly developed the habit of using this arrangement in all clusters. According to Jeengar et al. (2006), using machinery to cut down on drudgery was profitable and time-efficient (Figures 1, 2, and 3).

Seed bank

Farmers produced demand for small millets through the barter system (an exchange mechanism) or by gifting them to relatives when they visited their homes. This was made possible by the ongoing replacement of indigenous land races with superior kinds, which encouraged the increased production of small millets. In the end, this can become famous in unexplored regions and frequently spread over the weekly or daily local markets (Hadri or Pasra) in neighboring villages. The village seed bank was created as a result of the introduction of new technology and the encouragement of farmers. They have since begun to store the seeds in more conventional or advanced structures that are accessible to them, such as paddy storage facilities. They had a well-established system throughout the villages, so it was simple to maintain. In case of crop failure, this

Table 2. Impact of improved agro-techniques on yield potential of small finger millets (mean of ten years)

Target	Village	Farmer	Crop establishment			Nutrition			Varieties			Weed management		
			LS	BC	Increase %	Bal fert(NPK)	No Fert	Increase %	Imp	Local	Increase %	Herb	Local	Increase %
Cluster 1	7	15	20.23	5.23	386.81	17.78	6.05	294.12	22.58	7.13	316.69	20.44	7.18	284.68
Cluster 2	6	13	21.35	6.35	336.22	18.90	5.34	353.93	23.70	8.25	287.27	21.56	8.30	259.76
Cluster 3	8	21	18.25	3.25	561.54	15.80	4.56	346.49	20.60	5.15	400.00	18.46	5.20	355.00
Cluster 4	5	15	24.35	9.35	260.43	21.90	8.76	250.00	26.70	11.25	237.33	24.56	11.30	217.35
Cluster 5	6	14	26.67	9.67	275.80	24.22	9.80	247.14	29.02	13.57	213.85	26.88	13.62	197.36
Cluster 6	4	12	24.37	9.37	260.09	21.92	7.86	278.88	26.72	11.27	237.09	24.58	11.32	217.14
Cluster 7	3	17	17.89	2.89	619.03	15.44	6.09	253.53	20.24	4.79	422.55	18.10	4.84	373.97
Cluster 8	5	18	23.45	8.45	277.51	21.00	9.48	221.52	25.80	10.35	249.28	23.66	10.40	227.50
Cluster 9	5	15	23.34	8.34	279.86	20.89	10.35	201.84	25.69	10.24	250.88	23.55	10.29	228.86
Cluster 10	5	16	16.75	1.75	957.14	14.30	4.78	299.16	19.10	3.65	523.29	16.96	3.70	458.38
Mean	5.40	15.60	21.67	6.47	421.44	19.22	7.31	274.66	24.02	8.57	313.82	21.88	8.62	282.00

*LS, line sowing; BC, benefit:cost ratio; Bal Fer, balance fertilizers; NPK, nitrogen, phosphorus and potash and herb- herbicides.

Table 3. Impact of improved agro-techniques on yield potential of small kodo millets (mean of ten years).

Target	Village	Farmer	Crop establishment			Nutrition			Varieties			Weed management		
			LS	BC	Increase %	Bal fert (NPK)	No Fert	Increase %	Imp	Local	Increase %	Herb	Local	Increase %
Cluster 1	9.00	16.00	15.48	6.94	223.05	15.02	5.03	298.61	16.91	5.86	288.57	15.87	5.09	311.79
Cluster 2	8.00	13.00	16.60	8.06	205.96	16.14	4.32	373.61	18.03	6.98	258.31	16.99	6.21	273.59
Cluster 3	10.00	22.00	13.50	4.96	272.18	13.04	3.54	368.36	14.93	3.88	384.79	13.89	3.11	446.62
Cluster 4	7.00	15.00	19.60	11.06	177.22	19.14	7.74	247.29	21.03	9.98	210.72	19.99	9.21	217.05
Cluster 5	8.00	17.00	21.92	13.38	163.83	21.46	8.78	244.42	23.35	12.30	189.84	22.31	11.53	193.50
Cluster 6	6.00	13.00	19.62	11.08	177.08	19.16	6.84	280.12	21.05	10.00	210.50	20.01	9.23	216.79
Cluster 7	5.00	17.00	13.14	4.60	285.65	12.68	5.07	250.10	14.57	3.52	413.92	13.53	2.75	492.00
Cluster 8	6.00	19.00	18.70	10.16	184.06	18.24	8.46	215.60	20.13	9.08	221.70	19.09	8.31	229.72
Cluster 9	7.00	21.00	18.59	10.05	184.98	18.13	9.33	194.32	20.02	8.97	223.19	18.98	8.20	231.46
Cluster 10	8.00	17.00	12.00	3.46	346.82	11.54	3.76	306.91	13.43	2.38	564.29	12.39	1.61	769.57
Mean	**7.40**	**17.00**	**16.92**	**8.38**	**222.08**	**16.46**	**6.29**	**277.93**	**18.35**	**7.30**	**296.58**	**17.31**	**6.53**	**338.21**

*LS, line sowing; BC, benefit:cost ratio; Bal Fer, balance fertilizers; NPK, nitrogen, phosphorus and potash and herb- herbicides.

system would help to revive this in coming year as managed in this way. Areas expansion became easier when it was linked with seed production programme on farmers' field under rain fed condition for sustainability of small millets; whereas almost other cereals failed quite often

Table 4. Impact of improved agro-techniques on yield potential of small little millets (mean of ten years).

Target	Village	Farmer	Crop establishment			Nutrition			Varieties			Weed management		
			LS	BC	Increase %	Bal fert (NPK)	No Fert	Increase %	Imp	Local	Increase %	Herb	Local	Increase %
Cluster 1	6	13	12.48	3.94	316.75	12.02	3.25	369.85	13.91	1.29	1078.29	12.87	2.09	615.79
Cluster 2	5	10	13.60	5.06	268.77	13.14	2.54	517.32	15.03	2.41	623.65	13.99	3.21	435.83
Cluster 3	7	19	10.50	1.96	535.71	10.04	1.76	570.45	11.93	2.18	547.25	10.89	1.89	576.19
Cluster 4	4	12	16.60	8.06	205.96	16.14	3.96	407.58	18.03	5.41	333.27	16.99	3.29	516.41
Cluster 5	5	14	18.92	10.38	182.27	18.46	4.09	451.34	20.35	7.73	263.26	19.31	2.90	665.86
Cluster 6	3	10	16.62	8.08	205.69	16.16	3.06	528.10	18.05	5.43	332.41	17.01	1.97	863.45
Cluster 7	2	14	10.14	1.60	633.75	9.68	1.29	750.39	11.57	2.09	553.59	10.53	1.78	591.57
Cluster 8	3	16	15.70	7.16	219.27	15.24	4.68	325.64	17.13	4.51	379.82	16.09	3.20	502.81
Cluster 9	4	18	15.59	7.05	221.13	15.13	3.67	412.26	17.02	4.40	386.82	15.98	3.87	412.92
Cluster 10	5	14	9.00	0.46	1956.52	8.54	3.45	247.54	10.43	2.08	501.44	9.39	2.16	434.72
Mean	**4.40**	**14.00**	**13.92**	**5.38**	**474.58**	**13.46**	**3.18**	**458.05**	**15.35**	**3.75**	**499.98**	**14.31**	**2.64**	**561.56**

*LS, line sowing; BC, benefit:cost ratio; Bal Fer, balance fertilizers; NPK, nitrogen, phosphorus and potash and herb- herbicides.

due to vagaries of monsoon during crop period. It was a well-known fact that producers and consumers were similar in the past, leading people to grow in backyards or small spaces for personal consumption. However, with the guarantee of seed lifting, it transformed into a commercial enterprise. According to Yadav et al. (2007) in their demonstration of pulses, the construction of a seed bank in the village is a crucial issue for preparing the production chain.

Productivity enhancement

In comparison to local approaches used in surrounding fields, the technology adopted a higher yield level. Productivity increased as a result of the best management strategies' exceptional performance. Line planting, high-quality seed production, and balanced fertilizer were shown to be the most effective management strategies for increasing productivity (20-25 q/ha for ragi, 15-20 q/ha for kodo millet, and 5-7 q/ha for tiny millet). However, compared to grain production, local agronomic methods may yield just 2 to 5 q/ha. Converting as many areas as possible into productive ones by cultivating millets was a viable way to achieve environmentally acceptable management in the deteriorating agricultural environment (Figure 7). Singh et al.'s pulse demonstration produced a similar outcome (2005a).

Income enhancement

Although quality seeds like Foundation and certified seeds were sold on farmers' fields for Rs 30 to 40 per kg of produce through a buyback system under registration by the seed corporation, which led to farmers earning more money, income was undoubtedly increased when production of small millets increased and market demands peaked. Previously, there was no value of lands because of the barren lands, but Tables 5 to 7 demonstrate how quality seed production transformed those lands into productive lands. Similar results were also observed by Mukherjee (2003) and Reddy (2010) in the case of revenue enhancement through field demonstrations using technologies that initially supported farmers.

Value addition

Effective communication with both farm and non-farm individuals helped tiny millets gain popularity quickly. Grain must be processed after it is produced in order to be transformed into consumable forms, such as basic cooking and ready to eat. It contains items that can be made at home, such as ragi malt for tribal women and finger millet multigrain flour, while other forms that need slight primary

Figure 3. Side drain line under water logging condition.

Figure 4. Beushening for weed suppression in finger millet.

Figure 5. Pouring of seed and fertilizer in seed drill.

Figure 6. Bullock drawn seed cum fertilizer sown little millet

Figure 7. Root growth under good tilth.

processing like frying roasting etc was kept away in value addition of small millets, for which trainings and machinery support had been given them by linking other projects had the provision. According to Singh et al. (2005b), secondary agriculture's engagement increased demonstration adoption. In the end, they partnered with Sanjeevani, the Department of Forests in Chhattisgarh, and created the avenue for its sale via self-help group stores. The processing centre of the selected villages was equipped with grinding machine,

Table 5. Impact of technologies in income generation through seed and grain production of finger small millets in clusters.

Target	Seed production				Grain production				Areas coverage (%)			
	Cost of cultivation	Gross income	Net income	B:C ratio	Cost of cultivation	Gross income	Net income	B:C ratio	Income over grain production	Available upland	Previous	at present
Cluster 1	21336	57372.28	36036.28	1.69	12071	30345	18274	1.51	111.57	53	12	44.0
Cluster 2	22680	60548.60	37868.60	1.67	13415	32025	18610	1.39	120.36	45	13	45.0
Cluster 3	18960	51757.00	32797.00	1.73	9795	27375	17580	1.79	96.38	32	15	47.0
Cluster 4	26280	69056.60	42776.60	1.63	16915	36525	19610	1.16	140.40	54	16	48.0
Cluster 5	29064	75636.12	46572.12	1.60	20799	48006	27207	1.31	122.50	43	23	55.0
Cluster 6	26304	69113.32	42809.32	1.63	16939	36555	19616	1.16	140.54	37	18	50.0
Cluster 7	18528	50736.04	32208.04	1.74	10263	26835	16572	1.61	107.66	65	21	53.0
Cluster 8	25200	66504.20	41304.20	1.64	17935	42210	24275	1.35	121.10	54	19	51.0
Cluster 9	25068	66192.24	41124.24	1.64	18803	39678	20875	1.11	147.77	36	16	48.0
Cluster 10	17160	47503.00	30343.00	1.77	8095	25125	17030	2.10	84.05	45	20	52.0
Mean	23058.00	61441.94	38383.94	1.67	14503.00	34467.90	19964.90	1.45	119.23	46.40	17.30	49.30

*LS, line sowing; BC, benefit:cost ratio; Bal Fer, balance fertilizers; NPK, nitrogen, phosphorus and potash and herb- herbicides.

Table 6. Impact of technologies in income generation through seed and grain production of kodo small millets in clusters.

Target	Seed production				Grain production				Areas coverage (%)			
	Cost of cultivation	Gross income	Net income	B:C ratio	Cost of cultivation	Gross income	Net income	B:C ratio	income over grain production	Available upland	Previous	at present
Cluster 1	14246	46868	32622.08	2.29	8679	26670.0	17991.0	2.07	181.32	61	10	42
Cluster 2	20590	49820	29230.40	1.42	13023	28350.0	15327.0	1.18	190.71	53	11	43
Cluster 3	16870	41649	24778.80	1.47	11303	23700.0	12397.0	1.10	199.88	40	13	45
Cluster 4	24190	57728	33538.40	1.39	15623	32850.0	17227.0	1.10	194.69	62	14	46
Cluster 5	26974	63844	36869.92	1.37	17407	36330.0	18923.0	1.09	194.84	51	21	53
Cluster 6	24214	57781	33567.12	1.39	18647	32880.0	14233.0	0.76	235.84	45	16	48
Cluster 7	16438	40700	24261.84	1.48	10871	23160.0	12289.0	1.13	197.43	73	19	51
Cluster 8	23110	55356	32246.00	1.40	17543	31500.0	13957.0	0.80	231.04	62	17	49
Cluster 9	22978	55066	32088.04	1.40	17411	31335.0	13924.0	0.80	230.45	44	14	46
Cluster 10	15070	37695	22624.80	1.50	9503	21450.0	11947.0	1.26	189.38	53	18	50
Mean	20468	50650.74	30182.74	1.51	14001.00	28822.50	14821.50	1.13	204.56	54.18	15.72	47.16

*LS, line sowing; BC, benefit: cost ratio; Bal Fer, balance fertilizers; NPK, nitrogen, phosphorus and potash and herb- herbicides.

Table 7. Impact of technologies in income generation through seed and grain production of little small millets in clusters.

Target	Seed production				Grain production				Areas coverage (%)			
	Cost of cultivation	Gross income	Net income	B:C ratio	Cost of cultivation	Gross income	Net income	B:C ratio	income over grain production	Available upland	Previous	At present
Cluster 1	7423.00	23652.24	16229.24	2.19	6278.00	16369.56	10091.56	1.61	136.01	46	8	29
Cluster 2	9786.00	22120.80	12334.80	1.26	7641.00	14946.12	7305.12	0.96	131.84	38	9	30
Cluster 3	7047.00	23964.20	16917.20	2.40	4902.00	16659.52	11757.52	2.40	100.09	25	11	32
Cluster 4	11230.00	26176.28	14946.28	1.33	9085.00	18715.60	9630.60	1.06	125.55	47	12	33
Cluster 5	10223.00	29267.52	19044.52	1.86	8078.00	21588.84	13510.84	1.67	111.38	36	19	40
Cluster 6	9354.00	26488.24	17134.24	1.83	7209.00	19005.56	11796.56	1.64	111.94	30	14	35
Cluster 7	10234.00	21468.52	11234.52	1.10	8089.00	14339.84	6250.84	0.77	142.06	58	17	38
Cluster 8	9876.00	24531.40	14655.40	1.48	7731.00	17186.72	9455.72	1.22	121.33	47	15	36
Cluster 9	9805.00	23680.60	13875.60	1.42	7660.00	16395.92	8735.92	1.14	124.09	29	12	33
Cluster 10	8247.00	22064.08	13817.08	1.68	6102.00	14893.40	8791.40	1.44	116.29	38	16	37
Mean	9322.50	24341.39	15018.89	1.65	7277.50	17010.11	9732.61	1.39	122.06	39.18	13.72	34.16

packing machine and stencils used in processing of small millets. Three processing units are currently operational in Bastanar, Turenar, and Narayanpur. Due to their reliance on agriculture and the current farming system, tribal farmers are off-stream individuals who live outside of cities. This farming community has been targeted for agricultural improvement and extension during the past ten years, undergoing field visits, trainings, demonstrations, and other activities in order to improve the current system with positive outputs through farming in a sustainable way..

Research output enhanced yield

1. An important agronomic technique aimed at improving soil health and productivity sustainability is intercropping ragi and kodo millets. 4:1 and 4:2 (Ragi: Pigeon Pea) responded well in terms of generating revenue and bolstering the demand for pulses in addition to being profitable. According to Poonia and Pithia (2011), horse gram is an existing crop in the area that is chosen for intercropping.
2. The technique became lucrative when little millet and niger were planted consecutively because tiny millet is harvested in mid-kharif, or about August 20, and the soil moisture that remains can supply enough moisture to niger plants when they are rain-fed. In a zero-tillage technique, the niger crop is planted between harvested rows. Profitability would be increased if the price of niger was 25 to 30 rupees per kilogram.
3. The Poaceae family, which includes little millets, is renowned for conserving soil. Because there are fewer obstacles to flow during the wet season, upland conditions encourage top soil erosion and runoff. Farmers learned to cultivate little millets, which are always cultivated on well-draining, sloppy upland soil. Crops must be planted in rows across the hill in order to fix the issue, which will take hours.
4. Scooping is a technique that entails digging tiny ditches with a shovel every foot along the line between crop rows. In order to prevent short-term stress, the ditch assisted in water infiltration and extended the crops' duration of moisture availability by up to ten days.
4. The country plough's ability to run between rows would loosen the soil and suppress weeds at the same time, giving plants strength and yield-attributing qualities.
5. Nitrogen administered as a top dressing 20 and 40 days after sowing helped to increase yield, while the initial application of phosphate and potash as basal improved usage efficiency.
6. Compared to a blanket application of FYM, a hill placement of FYM and one nitrogen top dressing at 40 days allowed for adequate development and yield of tiny millets under rain-fed conditions.

Conflict of Interests

The authors have not declared any conflict of interests.

Figure 8. Bullock drawn seed cum fertilizer drill.

Figure 9. Transplanting of finger millet behind desi plough.

Figure 10. Harvesting of finger millet by reaper at farmer' field.

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