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# Use of Lignocellulolytic Microbes for In-situ and Ex-situ Wheat Residue Decomposition

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## ABSTRACT

Crop residue is one of the various kinds of agricultural waste produced annually. In order to handle the massive amount of crop leftover and have the field ready for the succeeding crop ahead of schedule, farmers choose to burn the residue. In addition to contributing to global warming, crop residue burning has grown to be a serious environmental vis-à-vis soil health concern. Taking into account the abovementioned circumstances, a participatory field trial was carried out during 2021-22 and 2022-23 in Pipariya Kalan and Khairi villages of Shahpura and Patan blocks of Jabalpur district in Madhya Pradesh. Rice-wheat farming, the primary cause of crop residue fires, was the pattern utilized in the trial. The current study aimed to compare three treatments: crop residue removal for ex situ decomposition (ED), in situ decomposition (ID), and residue burning (RB) in field. The pooled data of two years indicated that the ED residue completely decomposed in 52 d after use of lignocellulolytic bacterial and fungal based microbial consortia over traditional decomposition (TD) practices where it took 95 d. Organic carbon (14.88%), nitrogen (0.97%), phosphorus (0.55%), and potassium (0.79%) contents were greater in ED than that of residues decomposed conventionally. Soil samples from in situ decomposition (ID) and the RB fields were taken before onset of monsoon and analyzed for SOC, available N, P and K contents. The results of the in situ decomposition of wheat residue using bacterial and fungal base microbial inoculants and residue burnt (RB) fields showed that the soil organic carbon (SOC), available N, P, and K status decreased by 11.48, 27, 13.62, and 16.55 per cent in the burnt fields, respectively. These values were recorded as 0.61%, 175.66, 18.32, and 231.77 kg/ha in the RB fields, and 0.68%, 223.08, 20.81, and 270.13 kg/ ha in the ID fields respectively.

**Key Words**: Decomposition, *Ex situ*, *In situ* decomposition, Microbial inoculants, Residue burning.

## INTRODUCTION

India produces a large amount of crop residues every year, thirty percent of which contributed by rice and wheat. According to Singh *et al* (2019) rice and wheat contribute to 62% of the crop residue that is burnt, which accounts for 16% of the total quantity. Bhattacharjya *et al* (2019) estimated that 683 million tonnes of crop residue are produced on and off farms by ten key crops grown in India: rice, wheat, sorghum, pearl millet, barley, finger millet, sugarcane, potato tubers, pulses, and oilseeds. When harvesting the crop, combined harvesters leave a lot of standing stubble in the field because they don't remove entire plants. In India, 92 Mt of crop waste are burnt annually as a result of improper disposal practices (Bhuvaneshwari *et al*, 2019). Since burning crop residue is the most economical method of preparing the field for the next crop, farmers choose it as a simple and quick approach to manage the substantial volume of crop residue. One of the main causes of the country's rising agricultural residue burning rates is the replacement of human harvesting methods with mechanical ones through combination harvester harvesting, which is a consequence of a labour shortage. Crop residue burning in the field has been widely used in the states of Punjab, Haryana, Uttar Pradesh, and Uttarakhand after the harvesting of rice and wheat crops using combined harvester (Sarkar *et al*, 2018).

Gupta *et al* (2004) reported that burning crop stubble raises soil temperatures to 33.8–42.2 °C. Along with reducing the bacterial and fungal populations in the top 2.5 cm of the soil, burning

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also causes the soil's nitrogen content to be lost by 27–73%. Additionally, the bacterial population can be reduced by more than 50% by repeated burning. Long-term burning may reduce the amount of total N, C, and possibly mineralized N in the soil's top layer. The intact loss of paddy straw burning has been reported to be around 79.38, 183.71, and 108.86 kg/ha N, P, and K, respectively (Sahu *et al*, 2015). Therefore, continuing to remove and burn it could result in net nutrient losses, which would ultimately raise the cost of nutrient inputs in the short term and, in the long term, lower soil health and productivity. Moreover, burning residue is a primary source of trace gases and finer black carbon particles, which play a major role in the formation of ozone through photochemical reactions between its precursor VOCs and NOx, ultimately increasing radiative forcing into the atmosphere (Romasanta *et al*, 2017). According to a study, burning biomass is a major cause of air pollution in Asian nations, especially in China, India, and Indonesia, where air quality is rapidly declining (Andini *et al*, 2018). According to Gadde *et al* (2009) and IPCC (2013), open burning of residues also increases emissions of greenhouse gases (GHGs), including carbon dioxide ($CO_2$), methane ($CH_4$), and nitrous oxide ($N_2O$).

Ex situ decomposition, or composting, is a crop waste management practice that has been around for a few decades, but it is still important for sustainable crop residue recycling. However, there is not much research on the in situ or in-field the decomposition of crop residue utilizing microbial inoculums. It is a big challenge to not only achieve complete decomposition but also to increase the rate of in situ decomposition so that farmers can use the land for forthcoming crops. The residue's lignin and cellulose contents are thought to be the main factors controlling how quickly the material degrades. Prior studies (Hosseini and Aziz, 2013; Zhang *et al*, 2011) have employed acid or alkali pre-treatments to quicken the rate of decomposition in ex situ crop residue recycling; however, they are not practicable or cost-effective in in-situ conditions. Therefore, using lignocellulolytic microorganisms to speed up the breakdown of crop residues appears to be the most practical, affordable, and environmentally benign approach. Moreover, the in situ decomposition of crop residue may also increase soil health and productivity and enrich soil carbon (Sahu *et al*, 2015; Zhao *et al*, 2016; Goswami *et al*, 2019). Keeping in view the above, the present study was carried out to access the impact of impact of lignocellulolytic microbes on in-situ and ex-situ wheat residue decomposition.

## MATERIALS AND METHODS

In the villages of Pipariya Kalan and Khairi, which are situated in the Shahpura and Patan blocks of the Jabalpur district in Madhya Pradesh, after the wheat harvest, a participatory field trial was conducted in 2021–22 and 2022–23. The region is known for its primarily hot and humid weather. *Typic Haplusterts* are representative soil types of the testing sites; the soils are high in CEC and rich in base. The most common crops cultivated in the Shahpura and Patan blocks of the district are rice, wheat, blackgram, and greengram, as indicated by the cropping pattern (Table 1). Taking into consideration ,five farmer's fields were chosen in each village according to the current cropping pattern, with the local check placed next to trial plots. The objective of the current study was to compare three treatments: the removal of crop residue for ex situ decomposition (ED), in situ decomposition (ID), and residue burning (RB) in the field. For the ex-situ decomposition of wheat residues, 500 ml of bacterial consortia (a multi-blend strain of *Bacillus species*) and fungal consortia (fungi producing lignocellulolytic enzymes) per metric tonne of raw material were used twice at a 10-day interval. For the in-situ decomposition of wheat residues, 2.5 l/ha in the same ratio were used twice in the fields of chosen beneficiaries in both villages. After the wheat was harvested, the bacterial and fungal consortia were sprayed and field ploughed, then again after ten days after ploughing. Just before the monsoon arrived, soil samples were collected from the ID and RB fields. Standard methods given by Jackson (1958), Subbaiah and Asija (1956), Olsen *et al* (1954) and Jackson (1973) were used to analyse the soil samples for soil organic carbon, available nitrogen, phosphorus, and potassium.

**Table 1. Pattern of cropping in the study area (2021-22).**

| Block | Season wise area under crops | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | *Kharif* | | | *Rabi* | | | Summer | | |
| | Crop | Area (ha) | % Area | Crop | Area (ha) | % Area | Crop | Area (ha) | % Area |
| Shahpura | Rice | 13980 | 35.2 | Wheat | 28200 | 47 | Blackgram | 9935 | 55.3 |
| | Blackgram | 9775 | 24.6 | Garden Pea | 18120 | 30 | Greengram | 8025 | 44.7 |
| | Others | 15955 | 40.2 | Others | 13656 | 23 | Others | -- | -- |
| Patan | Rice | 32265 | 74 | Wheat | 35500 | 67 | Blackgram | 6500 | 50.8 |
| | Blackgram | 6030 | 14 | Garden Pea | 10000 | 20 | Greengram | 6300 | 49.2 |
| | Others | 5315 | 12 | Others | 7133 | 13 | Others | -- | -- |

**Table 2. Promising indicators of technology under ex situ decomposition of wheat residues (pooled data of two years).**

| Parameter | Unit | Observation (Pooled data of two years) | | |
|---|---|---|---|---|
| | | TD | ED | % increase |
| Dry matter | Mt /ha | 4.42 | 4.42 | -- |
| Decomposition | Days | 95 | 52 | (-) 82.7 |
| Compost | Kg/ha | 1865 | 2148 | 15.17 |
| Organic carbon | % | 12.95 | 14.88 | 14.9 |
| N content | % | 0.89 | 0.97 | 8.98 |
| P content | % | 0.53 | 0.55 | 3.77 |
| K content | % | 0.65 | 0.79 | 21.54 |
| Net nutrient cost of compost | Rs/ha | 3570 | 4111 | 15.15 |

## RESULTS AND DISCUSSION

Compared to traditional decomposition (TD) methods, which took 95 d for wheat residue to completely decompose, the pooled data of two years showed that under ED, wheat residue entirely decomposed in 52 d when bacterial and fungal consortiums were used (Table 2). In ED, the decomposition duration was 82.7 per cent shorter than with traditional methods, which improved the decomposition cycle. Eventually, 2148 kg/ha of compost were recorded, 15.17 per cent higher than with traditional decomposition (1865 kg/ha). The residues decomposed utilizing microbial consortia had estimated contents of 14.88, 0.97, 0.55, and 0.79 per cent of organic carbon (OC), N, P, and K. These values were 14.9, 8.98, 3.77, and 21.54 percent higher than those of wheat residues that were decomposed traditionally. The compost produced under ED had a net nutrient cost of Rs.4111/-, which was 15.15% greater than the

**Table 3. Nutrient status of soil under in-situ decomposition and residue burnt fields (Pooled data of two years).**

| Block | Soil organic carbon (%) | | | Available N (kg/ha) | | | Available P (kg/ha) | | | Available K (kg/ha) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ID | RB | % decline in RB | ID | RB | % decline in RB | ID | RB | % decline in RB | ID | RB | % decline in RB |
| Shahpura | 0.64 | 0.57 | 12.28 | 214.62 | 170.58 | 25.82 | 19.27 | 16.76 | 14.98 | 256.81 | 218.68 | 17.44 |
| Patan | 0.72 | 0.65 | 10.77 | 231.54 | 180.73 | 28.11 | 22.35 | 19.87 | 12.48 | 283.44 | 244.85 | 15.76 |
| Average | 0.68 | 0.61 | 11.48 | 223.08 | 175.66 | 27.00 | 20.81 | 18.32 | 13.62 | 270.13 | 231.77 | 16.55 |

compost prepared traditionally, which had a net nutrient cost of Rs.3570/. Sahu *et al* (2019) and Sahu *et al* (2020) have investigated the capacity of consortia of thermophilic and mesophilic microorganisms to degrade residue rapidly. These studies have demonstrated the potential of composting, or the rapid ex situ degradation of wastes, which may hasten the in situ decomposition of crop residue.

According to Table 3, which describes the nutrient status in soils of residue burnt (RB) and in situ wheat residue decomposition (ID) fields, the average SOC was 0.61 per cent in RB fields and 0.68 per cent in ID fields. The mean reduction in SOC as a result of burning residue was 11.48 per cent; however, Shahpura block fields had a higher rate of reduction (12.28%) than Patan sites (10.77%). In the RB fields of Shahpura and Patan blocks, available nitrogen was measured at 170.58 and 180.73 kg/ ha. This was 25.82 and 28.11 per cent less than in the ID fields, where it was determined at 214.62 and 231.54 kg/ha, respectively. Regardless of block, RB fields showed an average reduction in available N of 28%. The mean reduction in available P under RB fields was found to be 13.62 per cent; however, compared to ID fields in Shahpura and Patan blocks, it was 14.98 and 12.48 per cent less, respectively. In ID and RB fields, available K was measured to be 270.13 and 231.77 kg/ha, respectively, regardless of block, with an average decrease of 16.55 per cent in RB fields. Compared to Patan block, where it was estimated to be 15.76 percent, Shahpura block had a greater reduction in available K (17.44 %). Because of residue burning, the rate of reduction was lowest in SOC and greatest in available N. Karwariya *et al* (2014) reported that after residue burning in wheat fields, there was an average reduction of 17.32% in carbon, 12.69% in nitrogen, and 16.23% in potassium; in soybean residue burnt fields, there was a reduction of 9.95, 29.17, and 15.65% in carbon, nitrogen, and potassium. Bhattacharjya *et al* (2021) also reported that a significant amount of nutrients that were also lost as a result of burning residue could be returned to the soil through in situ residue decomposition using lignocellulolytic microbes, replenishing the soil nutrient reserve and lowering the need for fertilizer for the next crop. Additionally, in situ residue the decomposition might enhance soil health by enriching soil organic carbon (SOC), which frequently declines as a result of intensive cropping systems.

## CONCLUSION

The current study has shown that instead of burning crop residue, lignocellulolytic bacterial and fungal consortia can be used to decompose the residue both ex situ and in situ. Additionally, it increased the organic carbon (OC), accessible N, P, and K contents in ex situ and in situ decomposition, which in turn decreased the amount of nutrients from inorganic sources and the cultivation cost of the next crop. The compost preparation cycle increased as a result of the residues' quick disintegration by microbial consortia, enabling farmers access to more compost with higher levels of essential and beneficial nutrients.

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# Value Chain and Constraints Analysis of Ginger in West Garo Hills district of Meghalaya

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## ABSTRACT

Ginger is usually cultivated on hilly slopes or upland in jhum cultivation by the Garo tribe. The ginger growers follow the traditional dibbling method of cultivation. The planting materials are sown in the months of March and April. The crop takes around 8-9 months to reach its maturity stage. The study was conducted in six different villages with the objective of identifying the value chain in ginger, involving 60 respondents from the district. The study revealed that ginger soft rot or rhizome rot was a major problem for the farmers in the district. During the value chain analysis, it was observed that every year, the price of ginger fluctuated and middlemen earned a profit of Rs. 15-20/kg, wholesalers earned Rs. 5-10/kg, and small processing units, after adding value (ginger powder), earned a profit of Rs. 80-100/kg. However, due to a lack of well-established marketing facilities and value-added industries or facilities in the district, most of the product was exported to neighbouring states.

**Key Words** : Constraint, Ginger, Garo REGION, Growers, Marketing, Value chain.

## INTRODUCTION

India's agricultural system has experienced significant changes in recent decades. The traditional way of food production is being replaced by practices more similar to manufacturing processes, with greater co-ordination across farmers, processors, retailers, exporters and other stakeholders in the agriculture value chain (Kumar *et al,* 2011). The agricultural value chain framework encompasses a series of activities aimed at enhancing value, spanning from production to consumption, encompassing processing and marketing stages. Every segment of this chain is interconnected through backward and forward linkages. Different stakeholder of value chain are Government Agencies/Input Companies which provide support, infrastructure, financial assistance, and regulation for agricultural activities, Farmers who cultivate crops and livestock and performing primary processing and selling mainly to traders, Traders who purchase agricultural commodities directly from farmers, stockpile, and resell to larger traders or processors, Wholesalers who handle large quantities, own storage and transportation, and source from smaller traders or processors, Retailers who sell products directly to consumers, ranging from supermarkets to small shops and Consumers who are end-users who purchase and consume products or use them for manufacturing other goods or services (Arulmanikandan *et al,* 2023).

Ginger is commercially grown in almost all the states of the north eastern region, with Meghalaya, Arunachal Pradesh, and Mizoram as leading ginger-producing states. Prakash (2018) highlighted the value of growing ginger, stating that it is a significant cash crop in the Northeast. Meghalaya is the second-largest producer of ginger in the country after Kerala. Bag (2018) reported that, considering the rising demand for ginger as a health-beneficial item worldwide, emphasis has been placed on various government programs and the export potential of the country. The district is mainly dominated by Garo tribes, who cultivate ginger in jhum areas. For cultivation, they first cut and clear the vegetation in the selected area in the month of January. Cutting vegetation to clear the land is necessary for beginning agricultural operations in shifting cultivation (Singh and Devi, 2020). After cutting the trees and clearing the jungle, they leave the area to dry up.

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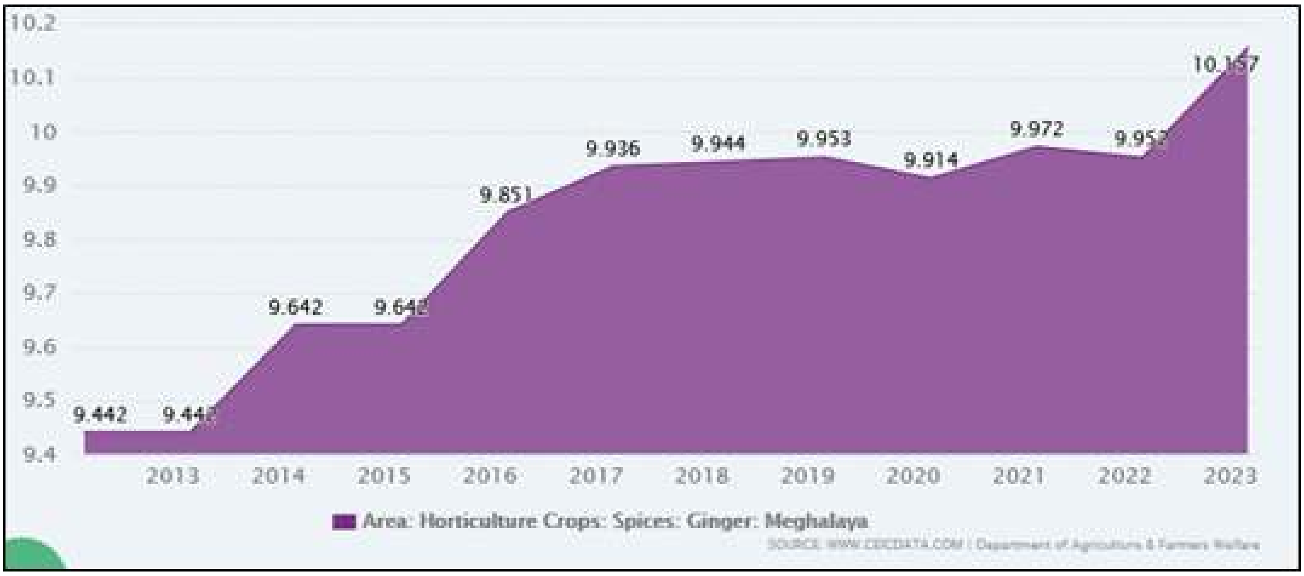
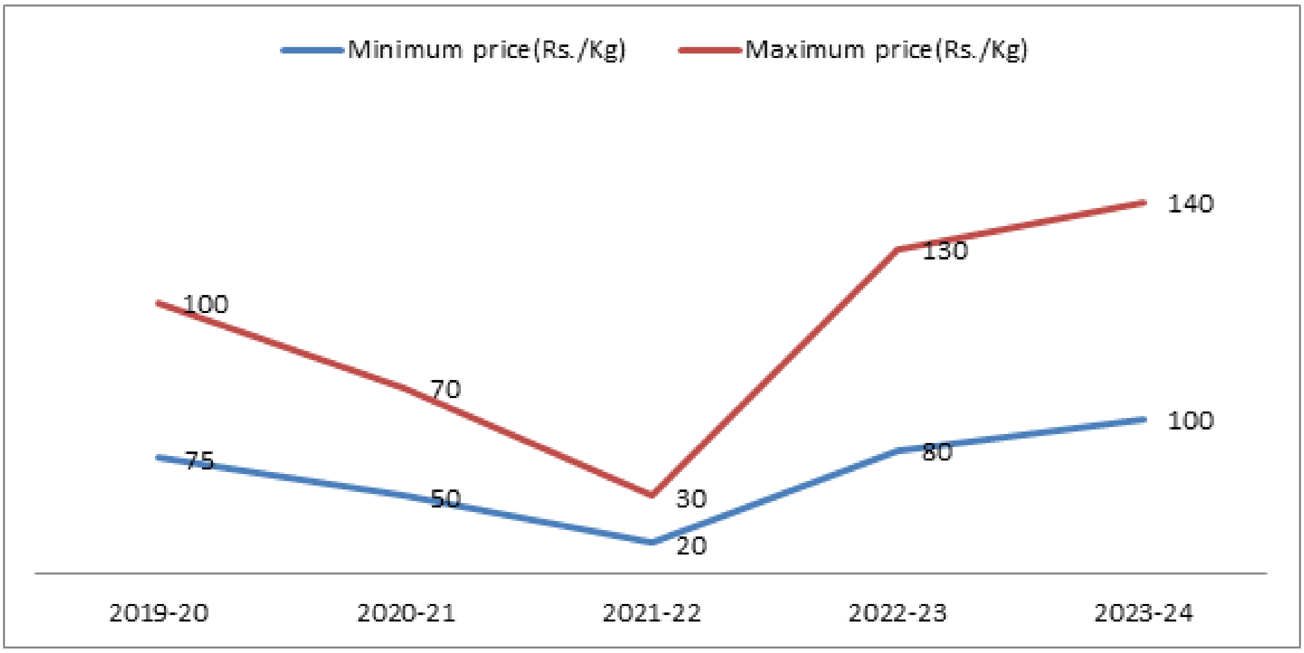
**Table 1. Increasing trend of area in ginger cultivation in Meghalaya.**




Source: https://www.ceicdata.com

**Fig 1. Average Market Price Variance (2019-2024)**



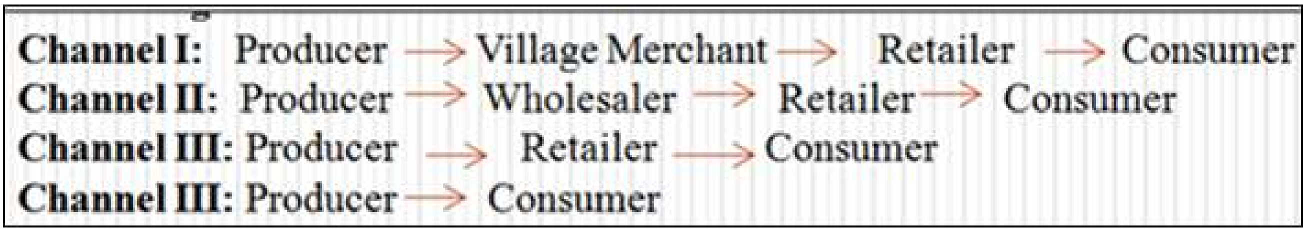

*Source: www.miemeghalaya.org/the-meghalaya-institute-of-entrepreneurship and modified*

Ginger is grown using the dibbling method with a locally made dibbler during the months of March or April. Ginger is a heavy feeder and demands nutrients continuously in large amounts. However, the use of large quantities of chemically formulated fertilizers is not feasible as it results in a progressive rise in multi-nutrient deficiencies, nutrient imbalance, and deteriorating soil health and productivity over time (Bindu and Podikunju, 2019). In the months of November and December, after harvesting the crop, it is sold in nearby weekly markets to retailers, middlemen, wholesalers, and small and medium processing units. The sale of the produce depends on the quantity harvested by the farmers. Some farmers sell their produce immediately, while others wait for better market prices. Adamade *et al* (2017) claimed that ginger is an essential crop with

**Table 1. Marketing Practices adopted by ginger farmers**

| Sl. Nos. | Channel used by growers | Frequency | Percentage |
|---|---|---|---|
| 1. | Selling in the nearest weekly market | 49 | 81.67 |
| 2. | Intermediaries/agent procuring form firm/home | 11 | 18.33 |

**Fig 2. Marketing channel of ginger in the district.**




*Source: Singh and Feroze(2018)*

medicinal, therapeutic, and herbal benefits that are beneficial in several facets of human life. However, the markets for ginger in the district always fluctuate. There is scope for improvement through value addition at the growers' level. Farmers can add significant value by processing and diversifying their raw ginger supply (Sangma and Kalita, 2022). The study explored the flow of ginger and its marketing patterns involving different agents or enterprises in the district.

## MATERIALS AND METHODS

The study was conducted in six different villages, namely Kamagre, Botegre, and Chandigre under Rongram block, and Amakgre, Nengja Bolchugre, and Aminda Simsang under Gambigre block, purposively. The data were collected through semi-structured interview schedules. Data were collected by randomly surveying 60 farmers, 20 middlemen, 20 retailers, 10 wholesalers, and 3 medium and 10 small processing unit holders. Secondary information was collected from the District Horticulture Office, articles, newspaper reviews, etc. The data were analyzed using simple statistical tools.

## RESULTS AND DISCUSSION

Marketing is problem for the growers because there is no established market for it. Producers sell the product to middleman, retailers, wholesalers and small or medium processing units. The price of the ginger depends on place to place and district to district. Transportation is another barrier for lowest price in the villages.

The maximum prize was in the year 2019, 2020,2022 and 2023 but in the year of 2022, farmers were in lost because of fall in prices of ginger. The reason reported for the same were less demand and rhizome rot in ginger. In 2021, some of the farmers did not harvest the crop because the cost of harvesting or production was higher than the selling price in the market. The produce was wasted in the field itself, and the farmers became demotivated.

### Marketing pattern

Due to transportation problem, most of the producer sells their produce to nearby market sometime at lowest price also. Only few farmers sell their product in good price because the good extension contact or available transportation facility. This was equally important in the trade and marketing of ginger where it always witnessed that the producers have no genuine fixture of price ( Mawlong, 2017).

The above table showed that 81.67 per of the ginger grower sell the produce in weekly market and only 18.33 percent sold to intermediaries/agent who is directly procuring form his/her firm/home. Generally, the growers who sell their produce from his/her firm because of immediate financial needs and afraid to destroy of the crop by wild animal like pigs.

**Fig 3. Value chain analysis of ginger with their margin.**

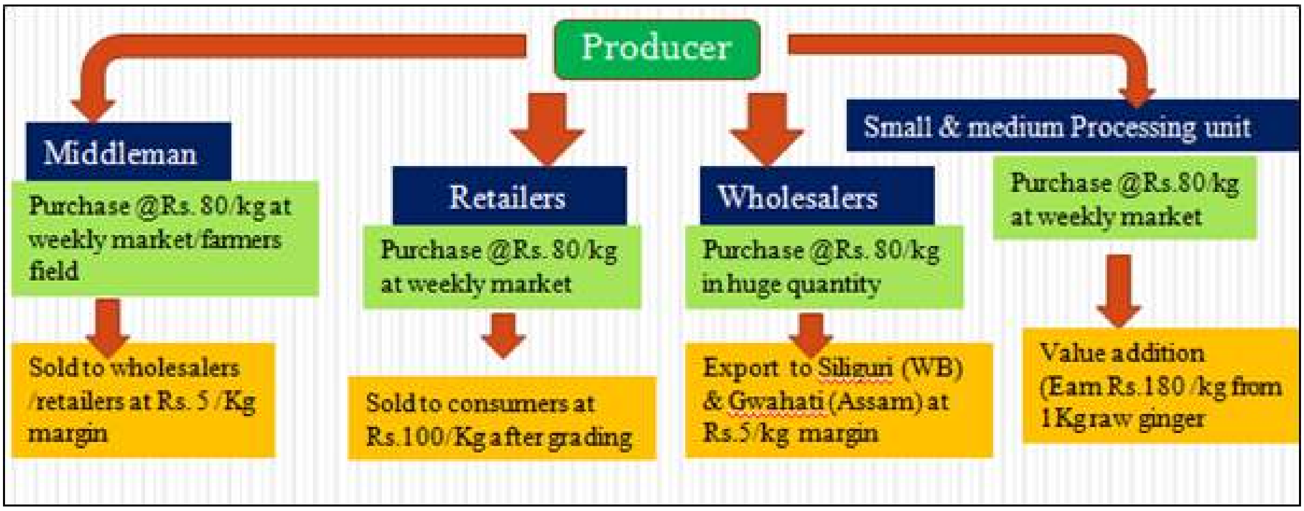



**Table 2. Constraints faced by the ginger grower.**

| Sr. No. | Constrain t | Agree | | Disagree | |
|---|---|---|---|---|---|
| | | No. | % | No | % |
| A. | **Seed/rhizomes related problems** | | | | |
| 1 | Availability of seed/seedlings insufficient quantity | 40 | 66.67 | 20 | 33.33 |
| 2 | Availability good quality seed/rhizome | 43 | 71.67 | 17 | 28.33 |
| 3 | Reasonable price of seed/rhizome | 48 | 80.00 | 12 | 20.00 |
| 4 | No special subsidy on seed/rhizome | 58 | 96.67 | 2 | 3.33 |
| 5 | Problem of rhizome rot | 59 | 98.33 | 1 | 1.67 |
| **B.** | **Input related problems** | | | | |
| 6 | Less know -how support from organization | 45 | 75.00 | 15 | 25.00 |
| 7 | Availability of inputs(organic fertilizers/FYM) | 57 | 95.00 | 3 | 5.00 |
| 8 | Availability of labour | 35 | 58.33 | 25 | 41.67 |
| **C.** | **Agronomic practices** | | | | |
| 9 | Availability of organic package of practice | 40 | 66.67 | 20 | 33.33 |
| 10 | Availability of extension training facilities | 25 | 41.67 | 35 | 58.33 |
| 11 | Weeds problem | 60 | 100.00 | 0 | 0.00 |
| 12 | Insect/pest problem | 52 | 86.67 | 8 | 13.33 |
| 13 | Availability of Government scheme | 4 | 6.67 | 56 | 93.33 |
| **D.** | **Marketing related problems** | | | | |
| 14 | Marketing through middleman/agents | 45 | 75.00 | 15 | 25.00 |
| 15 | Availability of regulated market | 5 | 8.33 | 55 | 91.67 |
| 16 | Un satisfactory market price during selling | 40 | 66.67 | 20 | 33.33 |
| 17 | High cost of production | 51 | 85.00 | 9 | 15.00 |
| 18 | Poor transportation/Own means of transport | 58 | 96.67 | 2 | 3.33 |
| **E.** | **Credit linkage facility** | | | | |
| 19 | Acquired loan from bank | 3 | 5.00 | 57 | 95.00 |
| 20 | Availability of credit facility | 5 | 8.33 | 55 | 91.67 |

**Value chain analysis**

Majority of the remote farmers bring their produced to the weekly market and sell their product before 12.0PM clock at market price set by the different agent/middleman. They are forced to do that because weekly market last upto 12.0PM usually and till this period maximum transaction of buying or selling is over. Ginger farmers have expressed concern over the fact that they were being forced to comply with weight deduction at the hands of traders. The farmers pointed out that out of every ton of ginger sold to traders; they lose around Rs 20,000 worth of ginger due to weight deduction (www.themeghalayan.com).

From the above figure, it was observed that farmers sell ginger to middlemen at Rs. 80 per kg. Middlemen then sell the same ginger to wholesalers or retailers at Rs. 85 per kg. Retailers sometimes purchase ginger directly from farmers at Rs. 80 per kg, and after minimal grading, sell it to consumers at Rs. 100 per kg. Farmers also sell their ginger to wholesalers at Rs. 80 per kg, who then transport it to Siliguri, West Bengal, and Guwahati, Assam for further processing. Wholesalers earn a profit of Rs. 5 per kg through this process. Although their profit per kilogram is small, they buy in large quantities, resulting in significant overall profit. Additionally, small processing units purchase ginger from the market at Rs. 80 per kg and, after some processing, sell it at Rs. 180 per kg, yielding a maximum profit of Rs. 100 per kg. This highlights the importance of value addition and processing in achieving higher income at the farmers' level. Value addition at the farmers' level could significantly increase their profits, considering that the retailers and wholesalers earn only Rs. 5 to Rs. 20 per kg.

**Constraints related to Ginger production**

In attempting to develop the ginger value chain, a number of constraints have been found which need to be addressed systematically and holistically. Some of the key issues are listed in Table 2

It was observed that 98.33% of respondents identified ginger rhizome rot as the major constraint related to seeds and rhizomes. This was followed by the lack of special subsidies for seeds/rhizomes (96.67%), the reasonable price of seeds/rhizomes (80.00%), and the availability of good quality seeds/rhizomes (71.67%). Regarding input-related constraints, 95.00% of respondents indicated that the availability of organic inputs was a major issue, while 75.00% cited a lack of know-how support from organizations. In terms of market-related constraints, poor transportation and high production costs were reported as major issues by 96.67% and 85.00% of respondents, respectively. It was also seen that all respondent (100%) said that weed problem is the major agronomical constrain followed by insect/pest problem (86.67 %) and availability of organic package of practice (66.67%).

## CONCLUSION

The study highlights the various supply chain in respect to ginger in Garo hills. Also, significant constraints faced by ginger farmers in Meghalaya, particularly those in Garo-dominated districts were studied. Major issues include ginger rhizome rot, lack of subsidies, high costs, and poor transportation. The availability of good quality seeds and organic inputs also pose challenges, alongside limited organizational support and fluctuating market prices. Despite these challenges, ginger remains a crucial cash crop for the region. To improve the ginger value chain, targeted interventions are essential. These include providing subsidies for seeds/rhizomes.., improving access to organic inputs, offering better organizational support, and enhancing transportation infrastructure. Addressing these issues can lead to increased productivity, higher farmer incomes, and enhanced market stability. Furthermore, promoting value addition and processing at the farmer level can significantly improve profitability and reduce post-harvest losses, ensuring a more sustainable and resilient agricultural system in Meghalaya. The small entrepreneur having processing unit earn profit of Rs.100 and retailers earn Rs.20 from1 kg raw ginger. The middleman and wholesaler earn profit of Rs.5- 10/Kg. Hence it can be said that ginger-based agro-entrepreneurship should be promoted.

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