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Popularization and Demonstration of Watermelon Technology under Irrigation in West Belesa District, Amhara Region

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Abstract

In the Amhara region, malnutrition problems are deep-rooted in rural households. To overcome such problems different food items should be produced and consumed at the household level by different production mechanisms. Among the food items, watermelon is one of the best food items which have tremendous nutritional value and can easily be produced by the farmer under irrigation. Before the trial was conducted the communities were not known how to produce watermelon as well as how to consume the fruit. To popularize this nutritional dense fruit in the area GARC introduced a new watermelon variety with the collaboration of PASDIP II. The experiment was conducted at Tena and Agamwuha irrigation scheme. The main objectives of these activities were to demonstrate watermelon technology under irrigation to assess farmers' and extension workers' reactions to the technology and strengthen linkage among stakeholders. Crimson sweet variety was demonstrated on 800 m2 plot of land. To evaluate the technology FREG was established. The FREG members got training about watermelon production and crop management as well as training on how to consume the fruit. The FREG members and other adjacent farmers were visited and evaluated the demonstrated technology by fruit yield, taste and market demand. After their observation and tasting of the fruit, the farmers were impressed and motivated to produce the crop in the next irrigation season for marketing purpose and their home consumption. The newly introduced variety was given a mean fruit yield of 24.72tha-1. To improve watermelon production as well as food consumption in the district and similar agroecologies crimson sweet variety with a full production package should be promoted under irrigation.

Keywords: Watermelon; Irrigation; FREG; Evaluation

Introduction

Watermelon *(Citrullus lanatus)* is part of Cucurbitaceae family and very common fruit worldwide, especially in arid and semi-arid climate environments (Bao et al., 2023; Gebeyhu & Markos, 2023). Watermelon can be grown at the mean optimum minimum and maximum temperature ranges from 18 °C and 35 °C, respectively (Jang et al., 2022). Watermelon contains about 6 % sugar and 92 % water by weight. It is a source of Potassium, Vitamin A, Vitamin C, Folate, and Amino acid. It also contains some of the most important antioxidants in nature- e.g. Lycopene (Tegen, Alemayehu, Alemayehu, Abate, & Amare, 2021).

Food insecurity and malnutrition problems are widespread in the Amhara region, and more specifically in west Belesa district (Beyadegie et al., 2019; Awoke, et al., 2022; Yehuala et al., 2023). To overcome such problems different food items should be produced and consumed at the household level by different production mechanisms. Among the food items, watermelon is one of the best foods which has tremendous nutritional value and can easily be produced by the farmers themselves under irrigation. It contains about 6 % sugar and 92 % water by weight. It is a source of Potassium, Vitamin A, Vitamin C, Folate and Amino acid. It also contains some of the most important antioxidants in nature- e.g. Lycopene (SHEP PLUS, 2019). West Belesa district has plenty of water resources and irrigation potential, but these are underutilized yet. Therefore, the introduction and popularization of watermelon could improve household income and watermelon consumption [1].

Nowadays watermelon is highly demanded by many consumers and has a wide range of markets. Watermelon can be grown on a wide range of soil types although sandy soils are preferred while the soil pH should be about 5.8 – 6.2. The highest yields will generally produce well-drained sandy loam soils. Heavy clay soils, soils with obstructed drainage, or very shallow soils should be avoided. Watermelon needs optimum temperature for germination. The temperature ranges from 27°C to 32°C, with night temperature not lower than 24 °C, and also need optimum temperatures for growth at night which ranges from 18°C to 20°C, and day 24°C to 30°C, and for ripening 15°C to 25°C temperature is required. There are different types of watermelon varieties such as Sugar Baby, Crimson Sweet, Charleston Grey, Sukari F1, and Sweet Rose F1 are the common varieties grown in large agroecology zones. Among these varieties, the Crimson Sweet variety was selected and demonstrated in west Belesa district [2].

Objectives

The main objectives of these activities were demonstrating watermelon technology under irrigation and to assess farmers and extension workers reactions about the technology and to strengthen linkage among stack holders.

Materials and Methods

Area description

The study was carried out in Tena irrigation scheme located in West Belesa district central Gondar administrative zone Amhara Region. The study area is geographically located between 12^0 13' 11" to 12^0 41' 4" N latitude and 37^0 37' 9" to 38^0 3' 8" E longitude. According to Ahmed, Tesfye, and Ahmed Yasin (2022), agroecology is predominantly

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lowland, covering 59.8% followed by temperate 38.7% and highland 1.5%. The altitude ranges from 1100m to 2350 m above sea level, while the annual temperature ranges from 13 °C to 35 °C. The mean annual rainfall ranges from 700 to 900 mm, and the rainy season starts in June and ends in September, where the rainy months are July and August. The farming system in the district is a mixed crop-livestock farming system. The district has good irrigation potential but is not yet utilized. The experimental sites were situated at flatlands suitable for irrigated agriculture with extensive Vertisols.

Agronomic Practices

To demonstrate the technology 4 selected farmers were participated in the district. Each selected farmer was allocated 200 m2 areas of land. The introduced variety in the district was the Crimson sweet variety. This variety is selected by the farmers and respective researchers based on productivity, market demand, colour, and sweetness during evaluation time conducted at West Belesa district, Tena irrigation scheme. The land was ploughed 2 times before planting.

The seeds were planted directly after preparing the planting pits while two healthy seeds were used per pit. The seed rate of the crop is 1-1.5 kg ha-1 depending on variety and spacing. The crop was planted by 1m * 2m between plant and row spacing, respectively. The fertilizers applied were 121 kg ha^{-1} of NPS and 100 kg ha^{-1} of Urea respectively. All NPS was applied at planting time and the urea was applied half at the planting and the remaining half was applied after 45 days of planting. All agronomic practice tillage (2-3 times), weeding (2 times), disease, and pest management were applied based on recommendations [3].

The crop was irrigated using the furrow irrigation method. The furrow was constructed near the plant root of the crop. To get optimum fruit yield every 7 days irrigation interval was applied. In the first emerging stage, the crop was irrigated every 3 days interval. Water deficit during flowering and fruit development causes serious yield reduction. Inversely, excessive irrigation makes mature fruits become cracked, tasteless, and watery. Therefore, optimum application of irrigation water is recommended for better fruit yield (Figure 1).

Crop management

Watermelon has a shallow root system therefore care should be taken to avoid bruising the roots during weeding. The frequency of weeding depends on weed infestation; generally keep the field weed-free as much as possible to avoid competition for nutrients, sunlight, and moisture. This can be done through the use of appropriate weeding tools. Weeding watermelon fields when the soil is wet can increase the spread of some bacterial (Bacterial Wilt) and fungal (Fusarium Wilt) diseases. More than 2 times weeding is very important. When the weeding activity is done only the root of the crop should be cultivated but the rest small weeds are not removed because the weeds are used as mulch and can prevent the fruit from direct sunlight.

Mulching is a recommended crop management practice for watermelon production. Mulching could be done using straw or dry leaves. The advantages of mulching practice are moisture conservation, weed suppression, preventing fruits from being in contact with soil and thus preventing pest & disease attacks.

Pest and disease management activities were done. Pest damage causes a reduction in the quality and quantity of products. The following are the major pests of Watermelon. Melon Fly, Aphids, Spider Mites, White Flies, Epilachna Beetles, and Root-knot Nematode. Disease infection leads to a reduction in the quality and quantity of products. The following are the major diseases of Watermelon. Among the diseases Powdery Mildew, Anthracnose, Downy Mildew, Fusarium Wilt, Gummy Stem Blight (Black Rot) and Watermelon Mosaic Virus (WMV) are common diseases that affect the productivity of the crop [4].

Post-Harvest technique

Watermelons don't ripen after they are picked so harvesting time is important. If harvested immature, red color will develop but sugar content does not increase after harvest. Harvesting should be done by cutting the vine and not pulling, twisting, or breaking off the vines. To harvest watermelon at an appropriate time the following physiological indicators are very important. Tendrils near the fruit stem have changed color from green to brown. Ground spot on the belly of the melon has changed from white to yellow. The fruits when thumped with the hand produce a muffled dull tone (immature fruits produce a clear metallic ringing tone). Mature fruits have a sweet flavour, crisp texture, and deep red colour. Handling should minimize fruit injury which may be caused by impact or abrasion. Shading is necessary to protect Watermelon from direct sunlight which causes sunburn.

Awareness creation activities

Inception workshop: One inception workshop was conducted at the center level by participating different stakeholders. Participants

Figure 1: Field performance of watermelon.

were the office of the agricultural head, kebele agricultural expertise, PASIDP focal person, and irrigation water user team members. During the workshop, each actor took their duty and responsibilities and they were motivated to support the activities conducted in the district (Table 1).

Farmers Research Extension Group (FREG) establishment: FREG establishment is a very pertinent activity. So to evaluate the technology one FREG was established in Asheker Terara kebele at Tena irrigation scheme. Farmers (FREG members) evaluated the technology based on the yield and taste of the fruit (Table 2).

Training: On-farm practical training was given to farmers and agricultural experts to improve skills and knowledge of watermelon production under irrigation and FREG concept and participatory research approach training was given (Table 3).

Data collection and analysis method

Both qualitative and quantitative data were collected. Among the data that was collected from watermelon production marketable and unmarketable yields, farmer's perceptions, financial data, and feedback. The collected data were analyzed by descriptive statistics like mean, standard deviation, minimum, and maximum, and also narrate the qualitative data based on contextual meanings [5].

Result and Discussion

Fruit yield

Crimson Sweet is the newly introduced watermelon variety in 2021 for Belesa and similar agroecologies under irrigation. The variety has a good taste and golden type fruit colour that is used for marketing. On average the variety needs 90 days to reach physiological maturity with an average fruit weight of 4.46 kg [6]. The variety was given a mean of 24.72 t ha-1 fruit. The technology is very attractive and profitable. Farmers can generate additional income by producing watermelon. Based on the productivity and farmgate prices of the fruit farmers can generate 370,800 ETB ha^{-1} (Table 4).

Food tasting and popularization

The crop was newly introduced in the district with the collaboration of PASIDP II and district office agriculture. Before the trial was conducted the communities were not known how to produce watermelon as well as how to consume the fruit. To test the fruit taste more than 144 farmers participated. The communities tasted and evaluated the fruit by consuming it. After their observation and tasting of the fruit, the farmers were impressed and motivated to produce the crop in the next irrigation season for marketing purpose and their home consumption. Then GARC purchased watermelon seed and distributed it to 10 producer farmers in the district [7].

Challenges and opportunities

Agricultural expert participation, farmer's irrigation practice, availability of irrigation infrastructure, and suitable soil conditions were some of the major opportunities. Inaccessibility of the market, shortage of improved watermelon seed, shortage and high cost of chemicals for protection, lack of market information, farmers' experience on watermelon production, and remoteness of the site were the most identified challenges that hinder the production of watermelon in the area [8].

Table 1: Purpose of stakeholder participation, Belesa, 2021.

Participants	Number	Purpose
Farmers	30	To create awareness, to popularize the technology, to make an impression about the profitability of watermelon production under irrigation
Fruit trader from Gondar town	1	To create understanding about watermelon production at the local level, to facilitate marketing, to motivate producers
Agricultural experts	10	To create awareness, to scale out the technology, to support the farmers
Trade office experts	2	To create awareness about watermelon production in the area, to facilitate marketing
Researchers		To transfer their technologies, to explain the technology how works under farmers' fields, to facilitate technology adoption, to establish linkage

Table 2: Taste of watermelon fruit, Tena irrigation scheme, 2022.

District	Scheme	FREG members		
		M	F	T
West Belesa	Tena irrigation	27	3	30

Table 3: Training participants, Tena irrigation scheme, 2022.

District	FREG			District expert			Kebele expert			Researcher			
	M	F	T	M	F	T	M	F	T	M	F	T	Total
Belesa	27	3	30	2	0	2	4	3	7	4	0	4	43

Table 4: Mean fruit yield in W/Belesa, 2021.

Site	Plot size	No fruit/plot	Average weight/fruit	kg/plot	t ha^{-1}	Average price ETB kg^{-1}	Gross Benefit
1	264 m^2	105	4.39	461.3	17.5	15	262080
2	400 m^2	323	3.5	1131	28.3	15	423945
3	60 m^2	31	5.5	170.5	28.4	15	426255
	Average yield				24.7		
			4.46			15	370800

Conclusion and Recommendation

By demonstrating the technology farmers and extension workers learnt about the technology and how to produce under irrigation conditions. Better fruit yield and benefit were obtained from the crimson sweet variety. Farmers were tested and impressed by the taste of the fruit and they preferred the technology over the other perishable crops and need to produce in the coming season. The technology is very profitable but the identified marketing and other agronomic problems should be solved. After solving the problem further popularization activity should be done in the district and similar agro-ecologies.

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