



Unlocking Agricultural Potential: An Economic Analysis of Transforming Barran Land into Leafy Greens Productive Assets

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Amaranthus, commonly known as amaranth it is incredibly nourishing, abundant in calcium, iron, magnesium and potassium as well as vitamins (A, C and folate), fiber, protein. It is a significant supplement to diets because it offers a balanced array of critical nutrients, particularly in areas where malnutrition is common. It might improve heart health by lowering inflammation, cholesterol, and blood pressure. Its high fiber content also helps to maintain digestive health and may help with weight management. This study was carried out to estimate proximate benefit cost ratio of greens

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cultivated in a barren land of 0.2acre in which five types of green vegetables were cultivated. The benefit cost ratio appeared to be 1:1.44 which denoted that the production of green vegetables in a barren land was beneficial and profitable. We summarized the chemical makeup of spinach, health benefits, its relative safety, and dietary inclusion in this review article, which was based on data compiled from our labs and those of other researchers.

Keywords: Greens; vegetables; spinach; nutrition; net income.

1. INTRODUCTION

Amaranth is a member of the *Amaranthus* genus, which is part of the Amaranaceae family and has 70 species spread throughout tropical and subtropical regions such as Garden beets, Spinach, Sugar beets [1]. It is a C4 photosynthetic plant species that is very productive, has a high genetic diversity and can adapt to a variety of soil and weather conditions, particularly dry soils and high temperatures. Amaranth species, including *Amaranthus viridis*, *A. dubius* and *A. tricolor* have been extensively researched for their nutritional value in seeds and vegetables. There is a global need to find more affordable and easily obtainable food options in order to enhance the nutritional status of the populace [2]. Related to Swiss chard and beets, spinach is a vegetable for cool weather. During the mild spring and fall temperatures, this quickly spreading plant produces a large number of leaves in a short period of time. It's important to extend the life of spinach plants when growing them, particularly in the spring when longer days cause them to wither. In particular, there is a need to find new and high-quality protein sources that are not derived from animals or conventional grains [3,4]. The selected greens (green vegetables) are mainly consumed for their leaf and stem part. These greens can be used as various sabzis (cooked vegetables) and can be consumed along with lentil, rice, roti etc., Apart from this can also be consumed as salads. The average cooking time for greens is about 3 – 4 minutes [5,6]. In biological systems, spinach leaves, which have a number of active ingredients, including flavonoids, which have antioxidative, antiproliferative, and anti-inflammatory effects [7-10]. Numerous positive effects, including anticancer and antiaging properties as well as protection of the central nervous system and chemotherapy, have been

shown for spinach extracts [12-14]. In India, Maharashtra, West Bengal, Gujarat, Andhra Pradesh, Telangana, Kerala, Tamil Nadu, Karnatak, and Uttar Pradesh are the states that produce the most spinach. The main objective of this study was to find out the yield of different *Amaranthus* species.

2. METHODOLOGY

Under the amaranth group, five green vegetables were selected for the study based on environmental and climatic conditions of the area chosen. Botanical and nutritive descriptions of the five vegetables are given below (Table 1).

The land measurement is taken for 0.2 acre and the total area is 809.371 sq.m and for each variety of greens different plot of land were divided (Fig. 1) each plot was 4 m x 3.5 m. Ploughing has been undergone 2 times with rotavator for the fine tilth of soil along with 250 kg of FYM and plots were divided for sowing. All four spinach species were direct seeded by broadcasting this was done during the first week of January expect for sessile joy weed which was planted using cuttings for broadcasting, seeds were mixed with sand in 1:10 ratio for easy and uniform sowing. The sessile joy weed cuttings were planted with a spacing of 12 cm x 15 cm with 50 cuttings. Immediately after planting light irrigation was given and then at weekly intervals. Since spinach's roots are comparatively shallow, it benefits from frequent, brief irrigations that keep the soil consistently moist for optimal leaf formation. Nonetheless, it's important to avoid overwatering spinach because it might become overly saturated, especially in areas with dense soil as it may result in wilting of plant. 3- 4 weeks after sowing the matured vegetative part of greens have been harvested.

Table 1. Botanical and nutritive descriptions of the five green vegetables [15]

S. No.	Botanical Name	Family	Common Name	Local name	Nutritional value and uses
1	<i>Amaranthus dubius</i>	Amaranthaceae	Indian spinach	Arai keerai	Provides proteins, fibers, calcium, iron, riboflavin, niacin and vitamin C and is an excellent source of lysin.
2	<i>Amaranthus viridis</i>	Amaranthaceae	Green amaranth	Thandu keerai	A decoction of the entire plant is used to stop dysentery and inflammations and also to purify the blood.
3	<i>Amaranthus tricolor</i>	Amaranthaceae	Chinese spinach	Sigappu thandukeerai	The roots of red spinach are used as a remedy for dysentery. It is highly recommended for consumption by patients with colon cancer, diabetes mellitus, high blood cholesterol
4	<i>Spinacia oleracea</i>	Amaranthaceae	Spinach	Palak keerai	It can help support immune function, aid the digestive system, may even have anticancer properties.
5	<i>Alternanthera sessilis</i>	Amaranthaceae	Sessile joy weed	Ponnangannikeerai	To treat hepatitis, tight chest, bronchitis, asthma and other lung troubles.

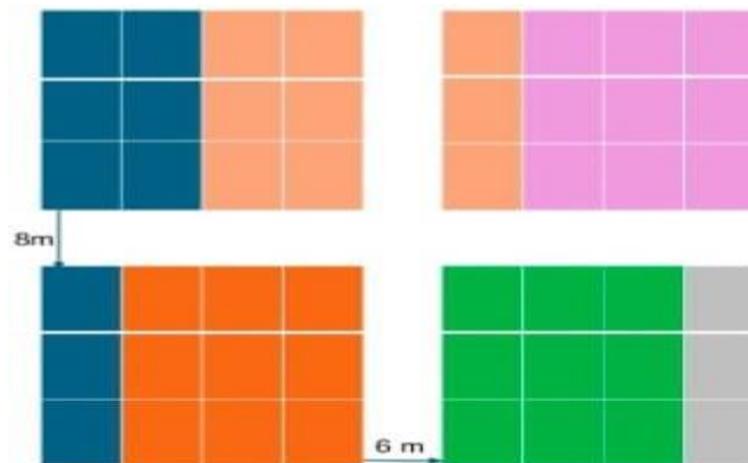


Fig. 1. Field layout

3. RESULTS AND DISCUSSION

Table 2. Seed rate and crop duration of five green vegetable [16]

S. No.	Particulars	Indian spinach	Green amaranth	Chinesespinch	Spinach	Sessile joyweed
1	Scientific Name	<i>Amaranthusdubius</i>	<i>Amaranthusviridis</i>	<i>Amaranthustricolor</i>	<i>Spinacaoleraca</i>	<i>Alternantherasessilis</i>
2	Seed rate / cutting per plot	50 g	50 g	50 g	50 g	50 cuttings
3	Propagation	Seed	Seed	Seed	Seed	Cuttings
4	Harvest	25 – 30 DAS	20 – 45 DAS	30 DAS	45 DAS	35 – 40 DAS

*DAS - Days after sowing

Table 3. Cost of cultivation and income of five green vegetables

S. No.	Particulars	Unit	Quantity	Rates (Rs.)	Amount (Rs.)
1	Seed	Rs./Kg	50 g	15	750/-
2	Land preparation	Rs./hr	1 hr	1000/-	1000/-
3	Basal application (FYM)	Rs./Kg	50 kg	10/kg	500/-
4	Sowing and Transplantation charge	Rs.	5 Labours	200/labour	1000/-
5	Fertilizer (Urea)	Rs./Kg	13 kg	242/-	242/-
INCOME					
7	Indian spinach	Rs./Kg	100	15	1,500/-
8	Green amaranth	Rs./kg	100	15	1,500/-
9	Chinese spinach	Rs.	100	15	1,500/-
10	Spinach	Rs.	100	20	2,000/-
11	Sessile joy weed	Rs./Kg	100	20	2000/-
	TOTAL INCOME Rs.			-	8,500/-
	Cost of cultivation (COC)	-	-	-	3,492/-
	Gross income	-	-	-	8,500/-
	Net income (NI)	-	-	-	5,058/-
	Economic B:C ratio (NI/COC)				1.6

Exchange rate: 1USD = 113.94

Selected 5 varieties of greens have been harvested in different intervals of time, totally 8 times harvested have been undergone. The plants were manually chopped off just below the crown with the help of hand sickle knotted into bunches of eight to twelve and packed twenty-four of these bunches or a minimum of twenty per gunny bag. These bags were weighed and marketed in local retail shops. Harvesting in proper interval of time is very important because if the harvesting gets delayed it may result in flowering and which leads to yield loss. Longer growing seasons are given to spinach, resulting in noticeably larger and thicker leaves. After a field has been trimmed, the plants grow again and may be harvested a second or third time.

The gross returns obtained in 0.2acre was Rs.8,500/- based on yield of good quality marketable leaves. With respect to net returns, it was Rs.3,492/-. Thus, cultivation of green leafy vegetables in the study area was found to be profitable as revealed by the net returns. The values of cost and returns were used to compute the benefit cost ratio and it resulted into a profitable benefit cost ratio in respect of all the greens. The magnitude of economic B:C ratio was 1:1.6 there by indicated higher returns for every rupee invested in the greens production in the study area. This study revealed that cultivation of selected amaranths is profitable even in a small area of land of 863 sq. m. area.

Greens offer notable socioeconomic advantages, particularly in tropical and subtropical areas where women predominantly cultivate and harvest green leafy vegetables to boost household income. In rural regions, traditional leafy vegetables serve as a vital source of nutrition, being available year-round and offering an affordable supply of vitamins and micronutrients to address nutritional deficiencies. These vegetables also provide a variety of phytochemicals like rutin and quercitrin, which have substantial applications in daily diets and industries, as well as in the medical field.

4. CONCLUSION

Greens (selected amaranth) hold significant potential as a sustainable crop that can enhance household food security and boost farmers' income. In arid areas where commercial crops like maize, beans and rice struggle to grow, greens cultivation can play a key role in achieving the first Millennium Development Goal of reducing hunger and poverty. Thus, greens

cultivation presents a promising avenue for supporting economic development and food sustainability. The benefit cost ratio of the selected green vegetables was 1:1.6, since the B:C ratio was greater than 1 the production is considered to be profitable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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