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Economic Benefits of Groundnut (*Arachis hypogaea* L.) + Sweet Sorn (*Zea mays* var. *Saccarata*) Intercropping System in South Gujarat

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ABSTRACT: In order to investigate crop intensification using a summer groundnut + sweet corn intercropping system, a field experiment was carried out on clayey soil at the Regional Rice Research Station, Navsari Agricultural University, Vyara, Gujarat, during the summer seasons of 2020–2021 and 2021–2022. Sweet corn (cv. Sugar-75) was mixed or intercropped with groundnuts (cv. GG-5). Ten treatments, including mix/intercropping systems, were assessed in a randomized block design with three replications. These treatments included the sole groundnut; sole sweet corn; groundnut + sweet corn in 1:1, 2:1, and 3:1 row ratio in replacement series; groundnut + sweet corn in 1:1, 2:1, and 3:1 row ratio in additive series; mix sowing of groundnut 80% + sweet corn 20% and groundnut + sweet corn (2:1) with paired row (30-60-30 cm). According to the experimental findings, groundnut yields from sole cropping were significantly higher than those from mixed or intercropped groundnut. However, the economics of these systems showed that, when compared to sole groundnut and other intercropping systems, intercropping of groundnut + sweet corn with paired row (30-60-30 cm) (2:1) was the most profitable in terms of gross returns, net returns and B:C ratio followed by intercropping of groundnut + sweet corn (3:1) in additive series.

Keywords: Groundnut, Sweet corn, Gross returns, Net returns and B:C ratio.

INTRODUCTION

Being a crop of worldwide importance, groundnuts are grown in over 100 countries throughout the world's tropics and subtropics. Since ancient times, groundnut has been a vital oilseed crop and the backbone of India's agricultural economy. India occupied 5.75 million hectares of groundnut area with a productivity of 1759 kg/ha and a production of 10.11 million tones (Anon., 2022a). Gujarat is the leading producer in India, accounting for 37.0% of overall production. Rajasthan, Andhra Pradesh, Madhya Pradesh, and Karnataka follow with 17.0%, 11.0%, and 8.0% of the total (Anon., 2022b). In Gujarat, during 2021–2022 summer groundnut was grown on an average area of 60.7 lakh hectares with a productivity of 2162 kg/ha and a production of 13.14 lakh tonnes. According to Anon. (2022c), the average area under summer groundnut cultivation in Tapi district for 2021–2022 was 2.22 lakh hectares, with a productivity of 2181 kg/ha and a production of 4.83 lakh tonnes.

India's agriculture faces new hurdles in the changing global agricultural scenario in order to compete globally in numerous agricultural commodities. Indian agriculture is currently dealing with second generation concerns such as fluctuating water tables, diseases and nutrients, environmental pollution and decreased agricultural profits. The low level of absolute income and the widening income gap between farmers and non-agricultural workers which has become even worse in recent years are the main causes of the agrarian distress that emerged in the nation in 1990. Given this, the target of doubling farmers' income by 2022–2023 can be extremely important in promoting farmers' welfare, reducing agrarian distress and achieving income parity between farmers and non-agricultural workers.

Improvements in productivity, resource use efficiency or cost savings in production as well as intensification and crop diversification toward high-value crops to boost farm income and profitability are the main drivers of growth in the agriculture sector.

Crop intensification is the practice of cultivating two or more crops on the same field in a given year in order to maximize yield from a given area. Crop intensification offers the chance to optimize crop yield per unit area and time, offering food security, self-sufficiency, crop failure insurance and judicious use of resources.

Groundnut-based intercropping system new approaches could be considered as groundnut can suitably be intercropped with maize for enhance productivity, profitability and sustainability of cropping system (Ghosh *et al.,* 2007).

In this area, groundnuts are the main crop. A vital and essential part of the farming system is animal husbandry. The haulm of groundnut which provides

valuable feed is primarily responsible for the supremacy of groundnut over time. Crop diversification is required in this situation and it should be profitable as well as supply feed. Sweet corn and groundnut intercropping are a suitable combination because legume + cereal is an ideal intercropping system. A further benefit of sweet corn is that it can produce green fodder after green cobs are harvested, which increases its market potential. Compared to regular grain corn, sweet corn can be harvested 80–90 days after seeding, which allows for a 35–45 day advantage. Its early maturity makes it easier to integrate into intensive cropping systems, which raises the overall annual cropping intensity.

Information on ideal groundnut based inter/mix cropping systems may lead to crop intensification in these region, with stabilized production and returns to the small and marginal farmers of this domain. Hence, a detailed study was proposed on crop intensification through summer groundnut + sweet corn intercropping systems.

MATERIALS AND METHODS

The field experiment was conducted during summer season of year 2020-21 and 2021-22 on clayey soil of Regional Rice Research Station, Navsari Agricultural University, Vyara. The experiment was conducted on clayey texture soil, which was medium in organic carbon (0.75 and 0.74%), neutral in reaction with pH (7.26 and 7.55) and EC (0.31 and 0.32 dS/m). The soil was medium in available nitrogen (296.3 and 307.1 kg/ha), medium in available phosphorus (32.3 and 34.3 kg/ha) and available potash (289.3 and 293.4 kg/ha).The climatic condition was favourable during the crop growth and development period.

Ten treatments comprising mix/intercropping systems *viz.,* sole cropping of groundnut (T_1) and sweet corn (T_2), replacement series of intercropping including groundnut + sweet corn in row ratio of (1:1) (T_3), (2:1) (T_4) and (3:1) (T_5), additive series of intercropping including groundnut + sweet corn with row ratio of (1:1) (T_6), (2:1) (T_7) and (3:1) (T_8), mix sowing of groundnut 80% + sweet corn 20% (T_9) and paired row sowing of groundnut + sweet corn (2:1) with (30-60-30 cm) (T_{10}) were evaluated in randomized block design replicated thrice. Using the standard package of practices, groundnut (cv. GG-5) was intercropped with sweet corn (cv. Sugar-75).

Fertilizers urea, diammonium phosphate and muriate of potash were applied as per recommended dose for groundnut and sweet corn based on the area occupied as sole and intercrops.

As per the treatment, sweet corn and groundnut seeds were sowed in fertilized furrows. After establishment, gaps were filled and at 15 DAS seedlings were thinned to maintain the required plant population. Plant protection measures were carried out in accordance with the needs. Sweet corn cobs were picked at the milky stage, while groundnut pods were separated by threshing after drying. Both sole and intercrops were harvested at their physiological maturity.

RESULTS AND DISCUSSION

The data on economics of groundnut based mix/intercropping systems of the individual years (2020-21 and 2021-22) as well as average of both the years in relation to gross returns, cost of cultivation, net returns and benefit: cost ratio are furnished in Table 1.

The relationship between the B: C ratio with pod/haulm yield of groundnut and cob/green fodder yield of sweet corn has been studied. The data on correlation (r) are shown in Fig. 1.

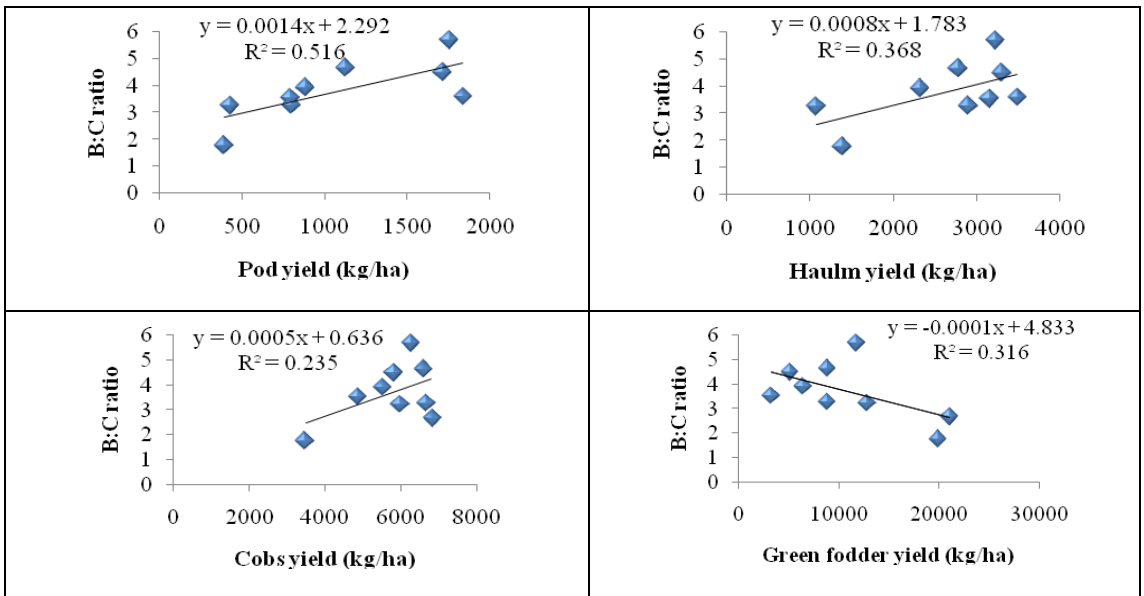

Fig. 1. Correlation between pod/haulm yield of groundnut and cob/green fodder yield of sweet corn with B: C ratio Result revealed that pod yield shown their significant correlation with B: C ratio whereas, haulm yield of groundnut and cob yield of sweet corn only showed positive correlation with B:C ratio. While, green fodder yield of sweet corn shown their non-significant correlation with B: C ratio.

The relationship between the B: C ratio with gross return and cost of cultivation has been studied. The data on correlation (r) are shown in Fig. 2. Result revealed that gross returns shown their highly significant correlation with B: C ratio whereas, cost of cultivation showed negative correlation with B: C ratio.

In a paired row (30-60-30 cm) (2:1), the intercropping of groundnut and sweet corn gave the highest gross and net return during both the year. An additive a series of sweet corn and groundnut intercropping (3:1) came next. Although the highest B:C ratio was achieved under intercropping groundnut + sweet corn with paired row (30-60-30 cm) (2:1) in average of both the years, followed by intercropping groundnut + sweet corn (2:1) in replacement series which might be due to its higher pod yield of groundnut under intercropping of groundnut + sweet corn with paired row (30-60-30 cm) (2:1) and higher market price of both groundnut pod and haulm as well as sweetcorn cob and green fodder during this period. However, the minimum B:C ratio (1.68, 1.87 and 1.78) was achieved with the treatment T_6 (Groundnut + sweet corn (1:1) in additive series) during the year 2020-21, 2021-22 and in average of both years, respectively which might be due to higher cost of cultivation.

The results of economics are akin to those reported earlier by Honnali and Chittapur (2014); Kithan and Longkumer (2017); Shwethanjali *et al.* (2018); Triveni *et al.* (2018); Chovatia *et al.* (2020); Baishya *et al.* (2021).

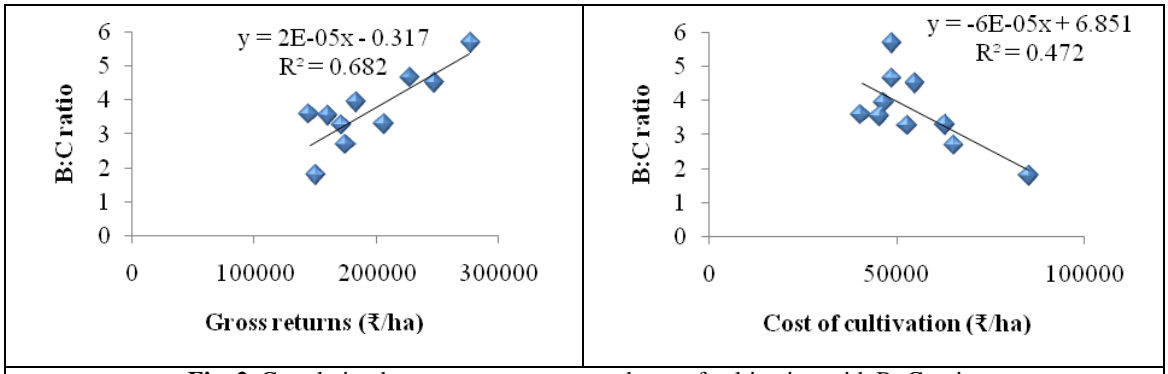

Fig. 2. Correlation between gross return and cost of cultivation with B: C ratio.

Table 1: Economics of treatment in summer groundnut and sweet corn based intercropping systems.

Treatments	Groundnut pod equivalent yield (kg/ha)	Gross returns (₹/ha)			Cost of cultivation (₹/ha)			Net returns (₹/ha)			B:C ratio		
		2021	2022	Av.	2021	2022	Av.	2021	2022	Av.	2021	2022	Av.
T_1	1831	137909	153350	145629	38868	42447	40657	99041	110904	104972	3.55	3.61	3.58
T_2	1605	170791	179701	175246	64217	66426	65322	106574	113275	109924	2.66	2.71	2.68
T_3	1832	163928	180267	172098	51542	54436	52989	112386	125831	119108	3.18	3.31	3.25
T_4	2670	210591	244122	227356	47303	50426	48865	163288	193696	178492	4.45	4.84	4.65
T_5	2181	172981	194467	183724	45205	48442	46823	127776	146025	136901	3.83	4.01	3.92
T_6	1212	140702	161976	151339	83894	86448	85171	56808	75529	66168	1.68	1.87	1.78
T_7	2362	190571	222035	206303	61381	64447	62914	129190	157588	143389	3.10	3.45	3.28
T_8	3073	237404	256755	247079	53473	56704	55089	183930	200050	191990	4.44	4.53	4.49
T_9	1936	148358	173878	161118	43938	47243	45590	104420	126635	115528	3.38	3.68	3.53
T_{10}	3221	265154	288597	276875	47303	50426	48865	217850	238171	228011	5.61	5.72	5.67

Groundnut	**2021**	**2022**	**Sweetcorn**	**2021**	**2022**
Prices of seeds (₹/kg)	105.0	105.0	Prices of seeds (₹/kg)	2700	2600
Selling price of pod(₹/kg)	70.0	70.0	Selling price of cob(₹/kg)	17.0	16.0
Selling price of haulm (₹/kg)	4.5	5.5	Selling price of green fodder (₹/kg)	3.0	3.0

CONCLUSIONS

Based on the findings of this two year field study of summer groundnut based mix/intercropping systems, it can be concluded that crop intensification through intercropping of groundnut with sweet corn in paired row (30-60-30 cm) (2:1) or intercropping of groundnut with sweet corn (3:1) in additive series could be adopted for obtaining more remuneration on clayey soil under south Gujarat heavy rainfall zone.

FUTURE SCOPE

Crop intensification through intercropping systems of groundnut and sweet corn offer several economic benefits and hold a promising future in regions like South Gujarat. Farmers can reduce financial risk by producing two crops at the same time and maximizing the size of land that is available. This could increase overall productivity per unit area and give farmers with multiple sources of income from a single plot of land. With two different crops, farmers can cater to different market demands and potentially achieve better prices. Shared inputs (like labor and irrigation) can reduce the overall cost of production compared to growing the crops separately. Further studies shall be done with planting densities, spatial arrangements and fertilization regimes can help in developing optimized intercropping practices. Detailed economic analysis comparing

intercropping with monocropping systems can provide insights into profitability and feasibility. It can also enhance biodiversity in agricultural systems, leading to more resilient ecosystems.

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Conflict of Interest. None.

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