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ECONOMICS OF MEDICINAL AND AROMATIC PLANTS IN ANDHRA PRADESH AND TELANGANA STATES

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ABSTRACT

The economics of medicinal and aromatic plants *viz.,* coleus and palmarosa has been worked out using farm- level data from the districts of Chittoor and Mahabubnagar in Andhra Pradesh and Telangana states respectively. The net returns over total costs have been found ₹ 161547.58 ha^{-1} in coleus and ₹ 77815.70 from main crop and ₹ 42568.57, ₹ 38385.33 and ₹ 34772.22 for ratoon I, II and III respectively.

KEYWORDS: Medicinal and aromatic plants, coleus, palmarosa

INTRODUCTION

Medicinal and aromatic plants (MAPs) are receiving considerable attention across the world because they offer a wide range of safe and cost effective, preventive and curative therapies which are useful in achieving the goal of 'health for all'. Though there are a number of important medicinal and aromatic plants, this study is limited to two common plants, *viz.* Coleus (*Coleus forskolii*), palmarosa (*Cymbopogan martini*). Coleus is one of the most potential medicinal plants of the future due to its pharmaceutical properties. It is widely used in scenting of soaps, cosmetics and tobacco blending. Against this back ground. The present study has been taken up to estimate the economics of these two medicinal and aromatic plants coleus and palmarosa.

MATERIAL AND METHODS

The study was conducted in Chittoor and Mahabubnagar districts in Andhra Pradesh and Telangana states respectively. The list of growers cultivating the above said crops were collected from the selected villages and 30 farmers for each crop were selected randomly. The total sample represented 60 farmers. The primary data were collected through personal interview using a pre – tested schedule for the year 2014-2015.

RESULTS AND DISCUSSION

Cost of Cultivation

The profitability of any enterprise depends up on income generating capacity and cost structure. Generally, costs in any economic study are discussed under two categories *viz*., operational costs and fixed costs. In general, operational costs alone are reckoned as the cultivation costs by farmers ignoring the fixed costs. The profit and loss too worked out accordingly .But in any economic analysis of any business enterprise, the fixed costs are also taken in to account to arrive at total cost and compute net profits.

Coleus

The particulars of cost of cultivation coleus are presented in Table 1. On an average the total cost of cultivation of coleus was ₹ 90452.42. It was found that, the operational costs accounted for a major share in the total cost of cultivation. The total operational costs were ₹ 74755.60.

It is evident that, the cost of both owned, hired human labour was the major cost component among operational costs with an amount of ₹ 47968 accounting for 53.03. The next important operational cost was manures and fertilizers with an amount of ₹ 11701.56 (12.94%). The other items of expenditure in the order of importance were seed (5.52%), machine power (4.25%), cattle labour (2.31%), interest on working capital (2.11%) plant protection chemicals (1.51%), and, irrigation charges (0.97%).

Fixed costs per hectare were estimated at ₹ 15695.82 accounting for 17.36 per cent of total cost of cultivation. The rental value of owned land was the major cost item among the fixed costs which accounted for 11.06 per cent. Depreciation, interest on fixed capital and land revenue were other fixed cost items accounting for 4.27, 1.86 and

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Table 1. Cost of cultivation of coleus (component-wise per hectare)

S. No.	Item	Amount (₹)
I.	**Operational Costs**	
1.	**Human labour**	47968 (53.03)
	Owned	3436 (3.80)
	Hired	44532 (49.23)
2.	**Cattle labour**	2084 (2.31)
	Owned	282 (0.31)
	Hired	1802 (2.00)
3.	**Machine power**	3848 (4.25)
	Owned	1190 (1.31)
	Hired	2658 (2.94)
4.	Seed	4997.06 (5.52)
5.	Manures and fertilizers	11701.56 (12.94)
	a. Manures	6000 (6.64)
	b. Fertilizers	5701.56 (6.30)
6.	Plant protection chemicals	1368.87 (1.51)
7.	Irrigation charges	876 (0.97)
	Interest on working capital	1912.11 (2.11)
	Total Operational Costs	**74755.60 (82.64)**
II	**Fixed costs**	
1.	Land revenue	150 (0.17)
2.	Rental value of owned land	10000 (11.06)
3.	Depreciation	3865.02 (4.27)
4.	Interest on fixed capital	1681.80 (1.86)
	Total fixed costs	**15695.82 (17.36)**
	Total costs	**90452.42 (100)**

0.17 per cent respectively. The results were found in accordance with the findings of Guleria *et al.* (2014).

Palmarosa

It is evident from Table 2 that, the cost of both owned, hired human labour was the major cost component among operational costs with an amount of ₹ 43348 accounting for 57.66 per cent of cultivation on palmarosa for the main crop. The next important operational cost was manures and fertilizers with an amount of ₹ 13686.83 (18.20%) main crop. The other items of expenditure in main crop in the order of importance were seed (6.46%), machine power (5.59%), cattle labour (3.09%), irrigation charges (1.50%), interest on working capital (1.23%) and plant protection chemicals (0.97%).

Fixed costs for main crop stood at ₹ 3687.44 accounting for 4.90 per cent of total cost of cultivation. The rental value of owned land was the major cost item among the fixed costs which accounted for 3.32 per cent. Depreciation, interest on fixed capital and land revenue were other fixed cost items accounting for 1.00, 0.53 and 0.05 per cent respectively. The results were found in accordance with the findings of Ramsuresh *et al.* (2012).

For ratoon-I the cost of labour (both owned, and hired) was the major cost component among operational costs with an amount of ₹ 29442 accounting for 69.16 per cent of cultivation on palmarosa. The next important operational cost was fertilizers with an amount of ₹ 7200 (16.91%) on palmarosa. The other items of expenditure in the order of importance were irrigation charges (2.42%), protection chemicals (1.65%), and interest on working capital (1.20%) plant, and on palmarosa farms. Fixed costs per hectare were estimated for at ₹ 3687.44 accounting for 8.66 per cent of total cost of cultivation. The rental value of owned land was the major cost item among the fixed costs which accounted for 5.87 per cent. Depreciation, interest on fixed capital and land revenue were other fixed cost items accounting for 1.77, 0.93 and 0.09 per cent respectively.

In ratoon-II the cost of both owned, hired human labour was the major cost component among operational costs with an amount of ₹ 26144 accounting for 68.10 per cent of cultivation. The next important operational cost was fertilizers with an amount of ₹ 6500.70 (16.93%). The other items of expenditure in the order of importance were irrigation charges (2.53%), protection chemicals (1.64%), and interest on working capital (1.17%) plant. Fixed costs per hectare were estimated at ₹ 3687.44

Table 2. Cost of cultivation of palmarosa (component-wise per hectare)

(in rupees per hectare)

S. No	Particulars	Main crop	Ratoon - I	Ratoon – II	Ratoon - III
		Amount (₹)			
I.	**Operational costs**				
1.	Human labour	43348 (57.66)	29442 (69.16)	26144 (68.10)	23092 (66.41)
	Owned	2328 (3.10)	1928 (4.53)	1528 (3.98)	1402 (4.03)
	Hired labour	41020 (54.56)	27514 (64.63)	24616 (64.12)	21690 (62.38)
2.	Cattle labour	2324 (3.09)	-	-	-
	Owned	286 (0.38)	-	-	-
	Hired	2038 (2.71)	-	-	-
3.	Machine power	4502 (5.99)	-	-	-
	Owned	1746 (2.32)	-	-	-
	Hired	2756 (3.67)	-	-	-
4.	Seed	4852.87 (6.46)	-	-	-
5.	Manures and fertilizers	13686.83 (18.20)	-	-	-
	a. Manures	5823.53 (7.75)	-	-	-
	b. fertilizers	7863.30 (10.45)	7200.30 (16.91)	6500.70 (16.93)	5986.96 (17.22)
6.	Plant protection chemicals	727.94 (0.97)	698.84 (1.65)	630.94 (1.64)	598.26 (1.72)
7.	Irrigation charges	1128.98 (1.50)	1028.84 (2.42)	972.74 (2.53)	945.64 (2.38)
8.	Interest on working capital	926.24 (1.23)	576.16 (1.20)	516.42 (1.17)	467.27 (1.33)
	Total operational costs	71496.86 (95.10)	38881.13 (91.34)	34697.89 (90.40)	31084.78 (89.65)
II	**Fixed costs**				
1.	Land revenue	37.50 (0.05)	37.50 (0.09)	37.50 (0.09)	37.50 (0.10)
2.	Rental value of owned land	2500 (3.32)	2500 (5.87)	2500 (6.50)	2500 (7.19)
3.	Depreciation	754.86 (1.00)	754.86 (1.77)	754.86 (1.97)	754.86 (2.17)
4.	Interest on fixed capital	395.08 (0.53)	395.08 (0.93)	395.08 (1.03)	395.08 (1.14)
	Total fixed costs	3687.44 (4.90)	3687.44 (8.66)	3687.44 (9.60)	3687.44 (10.35)
	Total costs	75184.30 (100)	42568.57 (100)	38385.33 (100)	34772.22 (100)

Table 3. Cost concepts in coleus cultivation
(rupees per hectare)

S. No.	Costs	Coleus
1	**Cost A1/A2**	75334.62
3	**Cost B1**	77016.42
4	**Cost B2**	87016.42
5	**Cost C1**	80452.42
6	**Cost C2**	90452.42
7	**Cost C3**	99497.66

Table 5. Output and returns of coleus and farms per hectare
(rupees per quintal)

S. No.	Particulars	Coleus
1	Yield (in Quintals)	1800.00
2	Gross returns	252000
3	Total costs	90452.42
4	Net returns	161547.58
5	Returns per rupee of expenditure	1.78

Table 4. Cost concepts in palmarosa cultivation
(rupees per hectare)

S. No.	Costs	Main crop	Ratoon - I	Ratoon - II	Ratoon – III
1	Cost A1/A2	69961.22	37745.49	33962.25	30475.14
3	Cost B1	70356.30	38140.57	34357.33	30870.22
4	Cost B2	72856.30	40068.57	36857.33	33370.22
5	Cost C1	72684.30	40640.57	35885.33	32272.22
6	Cost C2	75184.30	42568.57	35385.33	34772.22
7	Cost C3	82702.73	46825.43	39223.86	38249.44

Table 6. Output and returns of palmarosa farms per hectare
(rupees per hectare)

S. No.	Particulars	Main crop	Ratoon - I	Ratoon - II	Ratoon – III
1	Yield (quintals)	700	700	700	700
2	Gross returns	154000	140000	119000	105000
3	Total cost	75184.30	42568.57	35385.33	34772.22
4	Net returns	78815.70	97431.43	83614.67	70227.78
5	Returns of rupee expenditure	1.04	2.28	2.36	2.02

accounting for 9.60 per cent of total cost of cultivation. The rental value of owned land was the major cost item among the fixed costs which accounted for 6.50 per cent. Depreciation, interest on fixed capital and land revenue were other fixed cost items accounting for 1.97, 1.03 and 0.09 per cent respectively.

In ratoon - III the cost of (both hired and owned), hired human labour was the major cost component among operational costs with an amount of ₹ 23092 accounting for 66.41 per cent. The next important operational cost was manures and fertilizers with an amount of ₹ 5986.96 (17.22%). The other items of expenditure in the order of importance were, irrigation charges (2.38%), protection chemicals (2.38%), and interest on working capital (1.33%) plant. Fixed costs were estimated at ₹ 3687.44 accounting for 10.35 per cent of total cost of cultivation (Ramsuresh *et al.,* 2014).

Cost Concepts

The cost of cultivation of coleus and palmarosa was estimated by adopting the cost concepts used in farm management studies *viz.,* Cost A_1, Cost A_2, Cost B_1, Cost B_2, Cost C_1, Cost C_2 and Cost C_3. Of all the cost concepts, Cost C_2 is the most comprehensive cost as it covers both operational costs and fixed costs. The total cost of cultivation of coleus and palmarosa according to cost concepts was worked out and presented in Table 3.

Coleus

It is clear that from Table 3 there was no leasing in activity among the selected farmers and hence cost A_1 and cost A_2 were the same. On an average, the total cost of cultivation (Cost C_2) of coleus per hectare was ₹ 90452.42.

Palmarosa

From Table 4 It is clear that there was no leasing in activity among the selected farmers and hence cost A_1 and cost A_2 were the same. On an average, the total cost of cultivation (Cost C_2) was ₹ 75184.30 in main crop and same for ratoon I, II, and III, were ₹ 42568.57, ₹ 35385.33, and ₹ 34772.22 respectively.

Output and Returns

Coleus

From the Table 5 it is clear that the coleus farm recorded a yield of 1800 quintals per hectare. The gross returns obtained by ₹ 2,52,000. The total cost 90452.42. The net returns obtained was ₹ 161547.58 and returns per rupee of expenditure are ₹ 1.78.

Palmarosa

From the Table 6 it is clear that the palmarosa farm recorded a yield of 700 quintals of crop per hectare for main crop and for subsequent- ratoons as well. The average gross returns obtained were ₹ 1,54,000 in main crop and the same for ratoons were ₹ 1,40,000, ₹ 1,19,000, ₹ 1,05,000 respectively. The net returns obtained in were ₹ 78815.70, ₹ 97431.43, 83614.67, and ₹ 70,227.78 and returns of rupee expenditure during said cropping periods were ₹ 1.04, ₹ 2.28, ₹ 2.36, and ₹ 2.02 respectively.

CONCLUSION

According to the cost concepts analysis, Cost A1/ A2, Cost B1, Cost B2, CostC1, Cost C2, and Cost C3 were ₹ 75334.62, ₹ 77016.42, ₹ 87016.42, ₹ 80452.42, ₹ 90452.42 and ₹ 99497.66 on coleus farm respectively.

On palmarosa farms, Cost A1/A2, Cost B1, CostB2, Cost C1 Cost C2, and Cost C3 were main crop ₹ 69961.22, ₹ 70356.30, ₹ 72856.30, ₹ 72684.30, ₹ 75184.30, ₹ 82702.73 for main crop.

The coleus yield per hectare was 1800 quintals. The gross returns were ₹ 252000. In palmarosa yield per hectare was 700 quintals in each from main crop ratoon I, II, and III respectively, while the gross returns for the corresponding period years were ₹ 154000, ₹ 140000, ₹ 119000 and ₹ 105000 respectively.

The net returns per rupee of expenditure were ₹ 1.78 in coleus and the same in palmarosa were ₹ 1.04, ₹ 2.28, ₹ 2.36 and ₹ 2.02 for main crop and ratoon I, II and III respectively.

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EFFECT OF ZINC FERTILIZER DOSAGES ON GROWTH AND YIELD OF SPECIALITY CORN

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ABSTRACT

A field experiment entitled "Biofortification of Speciality corn with zinc" was conducted on sandy loam soils of Maize Research Center, Agricultural Research Institute, Rajendranagar during *kharif*, 2013 to study the effect of zinc nutrition in speciality corn. The experiment comprised of 18 treatments *viz.,* combination of three types of speciality corn [Popcorn, Sweet corn and Quality protein maize (QPM)] and six zinc levels [both soil and foliar application). The results revealed that three different types of corn and zinc levels significantly influenced growth parameters such as plant height, leaf area index(LAI), dry matter production and yield attributes such as cob number, number of grains per cob, cob girth and yield. Better growth and yield was registered with 25 kg $ZnSO_4$ ha^{-1}as soil application along with two foliar sprays i.e. at tasseling and milking stage. Sweet corn registered significantly higher number of cobs, longer cobs and maximum cob girth compared to QPM and popcorn. Number of grain rows per cob of popcorn was superior to QPM and sweet corn. Number of grains per row of QPM was significantly superior over popcorn and sweet corn. Green cob yield of sweet corn was significantly high and higher and lower grain yields were recorded with QPM and popcorn respectively. Likewise, sweet corn produced maximum green fodder yield compared to stover yield of QPM and popcorn.

KEYWORDS: Biofortification, popcorn, speciality corn, sweet corn, QPM, Zinc

INTRODUCTION

Maize (*Zea mays L.*) is emerging as third important cereal crop in the world after wheat and rice. It is called as "Queen of Cereals" due to the high productiveness, ease to process, low cost than other cereals (Jaliya *et al.*, 2008), besides serving as human food and animal feed with wide industrial application.

Speciality corn such as popcorn and sweet corn are popular snack foods whereas Quality Protein Maize (QPM) is important since it is enriched with tryptophan and lysine which provide nutritious food and feed for poultry, cattle. It also forms the basis as food material for poor people particularly for those with maize as staple food, thereby providing food and nutritional security.

Continuous intensive cropping of high yielding crop varieties has further aggravated the depletion of soil zinc leading to low zinc concentration in edible grains. Biofortification is a process in which plants are allowed to take up the minerals (Zn) from the soils and immobilize them in the grains so as to produce nutritionally rich grains that support dietary requirement of humans. Maize is high nutrient demanding crop but sensitive to zinc (Zn) deficiency in soil. Zinc deficiency in crops is the common problem world over; therefore, zinc malnutrition has become a major health burden among the resource poor people (Singh and Sampath, 2011). Application of Zn fertilizers could be a viable option to fulfill the crop demand for Zn and also to increase its content in grains. A field experiment was formulated to study the influence of soil and foliar applied Zn on the growth and yield of the speciality corn.

MATERIAL AND METHODS

A field experiment entitled "Biofortification with zinc in Speciality corn" was conducted during *kharif* 2013 at Maize Research Centre, Acharya N.G Ranga Agricultural University, Rajendranagar, Hyderabad, Andhra Pradesh. The experimental soil was sandy loam in texture with pH (8.2), EC (0.56 dS m^{-1}) and OC (0.42 %). The soil was low in available nitrogen (196 kg ha^{-1}), high in phosphorus (31.21 kg ha^{-1}), high in potassium (201 kg ha^{-1}) and deficient in zinc (0.62 ppm).

The experiment was laid out in a Randomized Block Design and replicated thrice. The treatments comprised of three Speciality corn *viz.,* Popcorn, Sweet corn, QPM and six zinc levels *viz.,* Zn_0: Control (only recommended dose of fertilizer), Zn_1: 12.5 kg $ZnSO_4$ ha^{-1} as Soil

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application, Zn_2: 25 kg $ZnSO_4$ ha^{-1} as Soil application, Zn_3:Zn_1 + 2 Foliar sprays at tasseling and milking stage ($ZnSO_4$ application @ 2g l^{-1} of water), Zn_4:Zn_2 + 2 Foliar sprays at tasseling and milking stage ($ZnSO_4$ application @ 2g l^{-1} of water), Zn_5: 2 Foliar sprays ($ZnSO_4$ application @ 2g l^{-1} of water) at tasseling and milking stage. A uniform dose of NPK (180 kg N – 60 kg P_2O_5 – 50 kg K_2O ha^{-1}) as per the recommendation was applied to all the treatments.

RESULTS AND DISCUSSION

Growth parameters

The results revealed that different levels of zinc in speciality corn significantly influenced the growth parameters such as plant height, LAI and dry matter production. Higher plant height in QPM was observed which was significantly superior over the plant height obtained with Popcorn and Sweet corn. Significant increase in plant height with different levels of 'Zn' along with RDF was probably due to cell and internodal elongation, plant metabolism, there by promoting vegetative growth which is positively correlated to the productive potentiality of plant which corroborates with the results of Masood *et al.* (2011). Soil application of $ZnSO_4$ @ 25 kg ha^{-1} along with two foliar sprays at tasseling and milking stages recorded maximum plant height which was superior over all other zinc treatments. Similarly taller plants in QPM might be due to inherent genetic potential of hybrid which outperformed both Sweet corn and Popcorn (Table 1).

QPM had shown higher LAI which was significantly superior over sweet corn and popcorn. Among the varied zinc levels soil application of 25 kg $ZnSO_4$ ha^{-1} along with two foliar sprays at tasseling and milking stage had significantly produced larger leaf area index. The increase in LAI could be attributed to significant increase in leaf expansion (length and breadth), high rate of cell division and cell enlargement, rapid growth and there by improved quality of vegetative growth due to applied Zn fertilizers along with RDF, which corroborates with the results of Jat *et al.* (2010) and Bisht *et al.* (2012).

Among the three types of corn the dry matter production was significantly higher with sweet corn with higher dose of zinc (Zn_4: 25 kg $ZnSO_4$ ha^{-1} as soil application+ two foliar sprays at tasseling and milking stage) compared to QPM and Popcorn. Higher dry matter production with three different types of speciality corn and zinc could be attributed to enhanced plant height, leaf area index and photosynthates accumulation, thereby improving the plant vigor due to source-sink relationship. These findings are in conformity with those of Tetarwal *et al.* (2011) and Ravi *et al.* (2012).

Flowering was delayed with zinc fertilization. Among the three speciality corns, sweet corn attained tasseling and silking 10-11 days earlier compared to popcorn and QPM. Among zinc levels, days to 50% flowering was found earlier (7-8 days) in no zinc treatment compared to the higher dose of zinc (Zn_4: 25 kg $ZnSO_4$ ha^{-1} as Soil application+ two foliar sprays at tasseling and milking stage).

Yield and Yield attributes

Yield attributes such as number of cobs ha^{-1}, cob length and cob girth obtained with sweet corn was significantly superior over QPM and popcorn. Number of grain rows per cob of popcorn was superior over QPM and sweet corn. Number of grains per row of QPM was significantly superior over popcorn and sweet corn (Table 2). Soil application of 25 kg $ZnSO_4$ ha^{-1} along with two foliar sprays at tasseling and milking stage had significantly produced longer cobs compared to all other zinc treatments. The use of both macro and micro nutrients often results in synergism and improvement of nutrient use efficiency which leads to better cob size. These findings are similar with the findings of Ravi *et al.* (2012).

Green cob yield of sweet corn increased significantly due to increased moisture content. Maximum green cob yield was recorded with sweet corn, while the higher and lower grain yield of was recorded with QPM and popcorn respectively. The higher yield was produced with Zn_4, while lower yield was recorded with Zn_0. Speciality corn and zinc has beneficial effect on physiological process, plant metabolism, growth, there by leading to higher grain or green cob yield. The nutrients also enhance the carbohydrates supply to kernels, increasing yield components such as cob length, cob girth and number of grains row^{-1}, which have direct influence on grain yield and green cob yield. Similar results were reported by Pokharel *et al.* (2009) and Kien *et al.* (2009).

Among three speciality corns sweet corn produced higher green fodder yield and registered higher and lower stover yield with QPM and Popcorn respectively. Application of higher dose of Zinc (Zn_4) produced higher yield, followed by Zn_2 and Zn_0 gave the lower stover yield.

Table 1. Growth parameters of maize as influenced by soil and foliar applied zinc

Treatments	Plant height (cm)	Leaf area index (LAI)	Dry matter production (kg ha^{-1})	Days to 50% tasseling	Days to 50% silking
Speciality corn types					
Popcorn	184.11	1.701	7842	49	55
Sweet corn	181.52	2.028	9372	38	45
QPM	199.43	4.133	8703	54	60
CD (P = 0.05)	11.44	0.151	279	3	4
Zinc levels					
Zn_0 (Control, only recommended dose of fertilizer)	180.44	2.177	8122	44	49
Zn_1 (12.5 kg $ZnSO_4$ ha^{-1} asSoil application)	185.94	2.272	8464	46	52
Zn_2 (25 kg $ZnSO_4$ ha^{-1} as Soil application)	195.86	2.891	9176	50	56
Zn_3 (Zn_1 + 2 Foliar sprays at tasseling and milking stage)	187.42	2.783	8553	47	53
Zn_4 (Zn_2 + 2 Foliar sprays at tasseling and milking stage)	197.24	3.416	9255	51	57
Zn_5 (2 Foliar sprays at tasseling and milking stage)	183.23	2.184	8264	45	51
CD (P = 0.05)	NS	0.214	394	4	6

Table 2. Number of cobs ha^{-1}, cob length (cm) and cob girth (cm) as influenced by different types of corn and zinc levels

Treatments	Number of cobs ('000 ha^{-1})	Cob length (cm)	Cob girth (cm)	Number of grain rows cob^{-1}	Number of grains row^{-1}
Speciality corn types					
Popcorn	39.29	17.36	8.92	14.06	38.45
Sweet corn	45.31	17.75	12.35	12.94	29.59
QPM	42.54	16.66	10.93	13.45	36.21
CD (P = 0.05)	0.44	NS	0.15	NS	0.18
Zinc levels					
Zn_0 (Control, only recommended dose of fertilizer)	39.58	16.10	9.97	12.77	32.44
Zn_1 (12.5 kg $ZnSO_4$ ha^{-1} asSoil application)	41.60	16.86	10.51	13.13	33.84
Zn_2 (25 kg $ZnSO_4$ ha^{-1} as Soil application)	44.42	18.30	11.41	14.26	36.86
Zn_3 (Zn_1 + 2 Foliar sprays at tasseling and milking stage)	42.36	17.30	10.70	13.36	34.49
Zn_4 (Zn_2 + 2 Foliar sprays at tasseling and milking stage)	45.47	18.50	11.56	14.36	37.63
Zn_5 (2 Foliar sprays at tasseling and milking stage)	40.77	16.50	10.26	13.02	33.23
CD (P = 0.05)	0.62	1.69	0.22	NS	0.25

Higher stover yield or green fodder yield among speciality corn and zinc were due to higher plant height, LAI, dry matter accumulation, more nutrient availability and uptake by speciality corn. These results are in conformity with the results of Septa and Kumar (2007) and Singh and Nepalia (2009).

Harvest index of sweet corn increased due to increased moisture content. Maximum harvest index was recorded with sweet corn, while the higher and lower harvest index was recorded with QPM and popcorn respectively. The higher harvest index was produced with Zn_4, while lower harvest index was recorded with Zn_0. Similar results were reported by Arif *et al.* (2010) and Rani *et al*. (2013).

CONCLUSION

Soil application of 25 kg $ZnSO_4$ ha^{-1} along with 2 foliar sprays at tasseling and milking stage (Zn_4) recorded higher growth and yield but it was on par with soil applied 25 kg $ZnSO_4$ ha^{-1} (Zn_2). Among the three types of corn (Popcorn, Sweet corn and QPM) tested, Sweet corn and QPM registered higher growth and yield compared to Popcorn. For southern Telangana zone of Telangana state sweet corn is better with a soil application of 25 kg $ZnSO_4$ along with two foliar sprays.

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