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Impact of Conservation Agriculture on Corm Quality of Elephant foot yam Intercropped in Banana

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Abstract

On-station and on-farm field experiments were conducted separately in series for three years during 2014-2017, to develop and validate resource conservation technologies for elephant foot yam in banana based system. In the on-station field experiment conducted at ICAR-Central Tuber Crops Research Institute, Thiruvananthapuram, Kerala, the effect of five treatments viz., conservation organic, conservation chemical, conventional chemical, conventional (package of practices (POP) as control) and organic management + conventional tillage were replicated four times in RBD. In the on-farm trial conducted in farmer's field at Alathara, Kattela, Thiruvananthapuram, Kerala, four varieties of elephant foot yam (Gajendra, Sree Padma, Sree Athira and Peerumade Local) were tested under two practices viz., farmer's practice (FP) and conservation chemical (CA) practice, replicated thrice in split plot design, with varieties in main plots and practices in sub plots.This paper reports the impact of conservation vs conventional agriculture vs farmer's practice on corm biochemical and mineral composition. The bio-chemical constituents of corm was not significantly affected by the management options both in the on-station and on-farm experiments indicating the equal efficiency of conservation agriculture to the existing conventional or farmers practices. Among the varieties, the corm proximate composition of Gajendra var. excelled with significantly higher starch, total sugar and crude fibre contents. Among the interactions, Gajendra var. of elephant foot yam intercropped with banana under conservation practice had higher starch and sugar contents in corms. All the varieties, irrespective of practices, except Sree Athira under CA, produced corms with higher crude protein content.The oxalate content was significantly the lowest in Sree Padma under CA and Gajendra under FP. The various management options did not significantly affect the mineral composition of corms, except Ca, Mg and Cu contents. The Ca and Mg contents of corms were significantly higher in conservation chemical and conservation organic practices respectively. The above result was further confirmed in the on-farm validation trial. It can be inferred that conservation agriculture is a safe alternative to the existing practices in elephant foot yam as the bio-chemical and mineral contents were not significantly altered.

Key words: Conservation agriculture, elephant foot yam, banana, proximate composition, mineral content

Introduction

Attaining food security for a growing population and alleviating poverty, while sustaining agricultural systems under the current scenario of depleting natural resources, negative impacts of climatic variability, spiraling cost of inputs and volatile food prices are the major challenges faced by Indian Agriculture (Bhan and Behera, 2014). In addition to these challenges, the principal indicators of non-sustainability of agricultural systems includes soil erosion, soil organic matter decline and salinization. Conservation agriculture (CA) is a set of principles for resource-efficient agricultural crop production based on three principles: minimum soil disturbance; permanent organic soil cover (consisting of a growing crop or a dead mulch of crop residues); and diversified crop rotations, in particular including legumes (FAO, 2010) (www.fao.org/ag/ca).

The CA has been reported to increase and stabilize yields, conserve soil moisture, increase soil carbon stocks, and improve soil physical and chemical properties (Rockström et al., 2009).The CA is recommended as a practice for sustainable crop production that simultaneously preserves soil and water resources (Hobbs, 2007; Hobbs et al., 2008). The positive effects of CA on soil and water conservation, environmental health, and economic viability is well known and it has been regarded as an environment-friendly technology and has been applied worldwide (Gupta and Sayre, 2007; Thomas et al., 2007; Lahmar, 2010). The effects of CA on crop yield is reported to be variable (Farooq et al., 2011; Zheng et al., 2014). A large body of evidence exists on the impact of CA in increasing crop yields by improving soil fertility as well as soil productivity, by conserving soil and water and sequestering organic carbon in soils (Holland, 2004; Govaerts et al., 2007; Liu et al., 2010). On the other hand, CA may also have detrimental impacts on crop yield by altering soil physico-chemical and biological conditions, such as decreasing soil temperatures in areas of high latitude and seasons with low temperature, and aggravating weed and disease incidence (Boomsma et al., 2010; Kaschuk et al., 2010; Deubel et al., 2011; Zheng et al., 2014). A scan of literature indicates that the impact of CA on the quality of produce is hitherto unexplored.

Elephant foot yam (*Amorphophallus paeoniifolius* (Dennst.) Nicolson) is an important tropical tuber crop popular as a nutritive vegetable and a food security crop, besides having medicinal values. Banana (vars. Robusta, *Musa* AAA and *Nendran*, *Musa* AAB) is an important cash crop, whose fully ripe fruit serves as a dessert delicacy. Besides, the mature raw fruits of *Nendran* are used for making chips and for culinary purposes and the starchy flour extracted from mature fruits serve as weaning food for infants. Intercropping sturdy crops like tuberous vegetables eg.,elephant foot yam, in association with banana augments net income from unit area per unit time, enables better utilization of resources, serves as an insurance against total crop loss and ensures food and nutritional security to resource poor farmers. The productivity and profitability of such association has been reported (Nayar and Suja, 2004). There is scope for low/ minimum tillage and hence CA in elephant foot yam + banana system due to sufficient biomass addition and nutrient recycling.

Presently, there is limited information on CA in tropical tuber crops. Moreover, less is known on the impact of CA on quality of produce. Hence, this paper reports the impact of conservation vs conventional vs farmer's practices on proximate and mineral composition of corms of elephant foot yam under intercropping in banana.

Materials and Methods

Site, climate, soil, design and treatments

On-station experiment

Field experiments were conducted for two consecutive seasons during 2014-2016 to develop resource conservation technologies for elephant foot yam in banana based system at ICAR-Central Tuber Crops Research Institute (8°29'N, 76°57'E, 52 m altitude) Thiruvananthapuram, Kerala, India. The total annual rainfall received during April 2014-March 2015 and April 2015-March 2016 was 1035.4 mm and 1735.4 mm respectively, maximum and minimum temperatures were 31.82°C and 24.04°C in the first year and 32.12°C and 23.73°C in the second year, and relative humidity was 81.46% and 83.53% in the first and second years respectively. The experimental soil was clayey in texture with pH 5.38, organic C 0.85%, available N 69.38 kg ha^{-1}, available P 54.87 kg $ha^{-1}$and available K 292.20 kg ha^{-1}.

The experiment was laid out in randomized block design (RBD) with five treatments viz., conservation organic (T_1), conservation chemical (T_2), conventional chemical (T_3), conventional (package of practices (POP) as control) (T_4) and organic management + conventional tillage (T_5), replicated four times. Description of treatments and nutrient management options in the various treatments are given in Tables 1 and 2. Elephant foot yam (var. Gajendra) was intercropped in banana (var. Robusta). The gross plot size was 9.6 m x 7.2 m accommodating 16 banana at a spacing of 2.4 m x 1.8 m and 60 elephant foot yam plants at a spacing of 90 cm x 90 cm. The net plot size was 4.8 m x 3.6 m

Table 1. Description of treatments

Notation	Treatments	Tillage + nutrient management + weed management practices
T_1	Conservation organic	Conservation practices such as minimum tillage#, crop residue retention, green manuring, + Non chemical method of weed management (cultural (mulching, green manuring) and mechanical (hand weeding)) and nutrient management by organic mode
T_2	Conservation chemical	Conservation practices such as minimum tillage, crop residue retention, green manuring + Chemical method of weed management$ and need based application of manures and fertilizers based on soil testing*
T_3	Conventional chemical	Conventional tillage**, mulching + Chemical method of weed management* and need based application of manures and fertilizers based on soil testing
T_4	Conventional (POP) (Control)	Existing Conventional practice: conventional tillage, mulching + hand weeding and FYM @ 25 t ha^{-1} and NPK @ 100:50:150 kg ha^{-1}
T_5	Organic management + conventional tillage	Conventional tillage, mulching + hand weeding and organic method of nutrient management

$ Pre-emergence application of Oxyfluorfen @ 0.2 kg ai ha^{-1} within 6 days of planting

* Based on Aiyer and Nair (1985) in the first year 90% N, 0 P and 60% K; Second year 90% N, 0 P and 83% K of the POP recommendation of NPK to both the crops

Minimum tillage: One ploughing, digging for pit formation alone, one weeding

** Conventional tillage: Two ploughings, digging of entire area before pit preparation, two weedings

Crop residue addition in T_1 and T_2 @ 7 tha^{-1}

Fresh biomass from green manure cowpea in T_1, T_2 and T_5 were 7.78, 1.55, 8.57 t ha^{-1} in the first year and 7.47, 2.83 and 5.59 t ha^{-1} in the second year

Table 2. Description of nutrient management options

Treatments	Nutrient management mode	Banana	Elephant foot yam
Conservation organic (T_1)	Organic	FYM @ 10 kg $plant^{-1}$ at planting + organic manures to supply NPK @ 160:160: 320 g $plant^{-1}$ $year^{-1}$ in 2 equal split doses at 2 MAP and 4 MAP	Seed treatment in FYM + neem cake + *Trichoderma* slurry. Application of FYM @ 36 t ha^{-1}, *in situ* green manuring, neem cake @ 1 t ha^{-1}, ash @ 3 t ha^{-1}
Conservation chemical (T_2)	Chemical based on soil testing	FYM @ 10 kg $plant^{-1}$; NPK @ 144:0:200 g $plant^{-1}$ (first year) & 144:0:255 g $plant^{-1}$ (second year)	FYM @ 25 ha^{-1}; NPK @ 90:0:90 kg ha^{-1} (first year) & 90:0:120 kg ha^{-1} (second year)
Conventional chemical (T_3)	Chemical based on soil testing	FYM @ 10 kg $plant^{-1}$; NPK @ 144:0:200 g $plant^{-1}$ (first year) & 144:0:255 g $plant^{-1}$ (second year)	FYM @ 25 t ha^{-1}; NPK @ 90:0:90 kg ha^{-1} (first year) & 90:0:120 kg ha^{-1} (second year)
Conventional (POP) (Control) (T_4)	Chemical as in POP	FYM @ 10 kg $plant^{-1}$ at planting + NPK @ 160: 160:320 g $plant^{-1}$ $year^{-1}$ in 2 equal split doses at 2 MAP and 4 MAP	FYM @ 25 t ha^{-1} and NPK @ 100:50:150 kg ha^{-1}; twice at 45 DAP and 1 month after the first application ie., 75 DAP
Organic management + conventional tillage (T_5)	Organic	FYM @ 10 kg $plant^{-1}$ at planting + organic manures to supply NPK @ 160:160: 320 g $plant^{-1}$ $year^{-1}$ in 2 equal split doses at 2 MAP and 4 MAP	Seed treatment in FYM + neem cake + *Trichoderma* slurry. Application of FYM @ 36 t ha^{-1}, *in situ* green manuring, neem cake @ 1 t ha^{-1}, ash @ 3 t ha^{-1}

accommodating 4 banana and 32 elephant foot yam. Banana was planted in pits of 50 cm^3 and elephant foot yam in 60 x 60 x 45 cm^3 sized pits. The results of the first two seasons are reported here.

On-farm experiment

A field experiment was conducted during 2016-2017 in a farmer's field at Alathara, Kattela, Sreekariyam, Thiruvananthapuram, Kerala, India. The site experiences a typical humid tropical climate with bimodal annual pattern of rainfall.The total annual rainfall received during May 2016 to March 2017 was 854.10 mm, maximum and minimum temperatures were 30.83^{o}C and 23.92^{o}C, and relative humidity was 81.22%.The experimental soil was clayey in texture with pH 5.10, high status of organic C (1.32%), available P (35.16 kg ha^{-1}) and available K (308.86 kg ha^{-1}) and low available N (144.65 kg ha^{-1}).

The experiment was laid out in split plot design in a banana (var. Nendran) field, with four varieties of elephant foot yam (Gajendra, Sree Padma, Sree Athira and Peerumade Local) in main plots and two practices (farmer's practice (FP) and conservation chemical (CA) in sub plots and replicated thrice. Description of practices and nutrient management options are given in Tables 3 and 4.

Gajendra is a variety released from Vegetable Research Station, Rajendra Nagar, under the aegis of All India Co-ordinated Research Project (AICRP) on Tuber Crops, which is a selection from local collections of Kovvur, West Godavari district, Andhra Pradesh. It produces an average yield of 42.00 t ha^{-1} (potential yield of 55.00 t ha^{-1}) in 180-210 days (AICRP, 2012). Sree Padma is a selection from indigenous germplasm collection from Wyanad, Kerala with an average yield of 42.00 t ha^{-1} and potential yield of 80.20 t ha^{-1}, released from ICAR-CTCRI. Sree Athira is a hybrid selection released from ICAR-CTCRI, Thiruvananthapuram, that matures in 9-10 months and yielding 40.50 t ha^{-1} (CTCRI, 2006). Peerumade local is a local high yielding variety with good market preference and excellent cooking quality, procured from Peermade Development Society, Pothupara, Idukki district, Kerala.

The gross plot size was 8 m x 4 m accommodating 8 banana at a spacing of 2 m x 2 m and 32 elephant foot yam plants at a spacing of 90 cm x 90 cm. Banana was planted in pits of 50 cm^3 and elephant foot yam in 60 x 60 x 45 cm^3 sized pits.

Table 3**.** Description of treatments

Treatments	Tillage + nutrient management + weed management practices
Farmer's practice (FP)	Conventional tillage** + mulching + application of manures and fertilizers + hand weeding
Conservation chemical (CA)	Conservation practices such as minimum tillage#, crop residue retention, green manuring + chemical method of weed management$ + need based application of manures and fertilizers based on soil testing*

**Conventional tillage: Two ploughings, digging of entire area before pit preparation, two weedings

Minimum tillage: One ploughing, digging for pit formation alone, one weeding

$ Pre-emergence application of Oxyfluorfen @ 0.2 kg ai ha^{-1} within 6 days of planting

* Based on Aiyer and Nair (1985) 78% N, 0 P and 25% K of the POP recommendation of NPK to both the crops

Crop residue addition in CA @ 7 t ha^{-1}

Fresh biomass from green manure cowpea in CA was 1.15 t ha^{-1}

Table 4. Description of nutrient management options

Treatments	Nutrient management mode	Banana	Elephant foot yam
Farmer's practice (FP)	Without soil testing	FYM @ 25 t ha^{-1},Neem cake @ 4.4 t ha^{-1} , Bone meal @ 0.6 t ha^{-1}, ash @ 4.4 t ha^{-1}, Musoorie Phosphate 2000 kg ha^{-1}, Muriate of Potash 1500 kg ha^{-1}	Neem cake @ 3 t ha^{-1}, Poultry manure @2.6 t ha^{-1} , Bone meal @ 1.5 t ha^{-1}
Conservation chemical (CA)	Chemical based on soil testing	FYM @ 25 t ha^{-1}, NPK @ 148:0:75 g plant^{-1}	FYM @ 21.5 t ha^{-1} , NPK @ 78:0:25 kg ha^{-1}

Corm quality estimation

The elephant foot yam crop was harvested nine months after planting during the three years and the plot wise fresh corm samples were collected and analysed for biochemical characters and mineral content. Proximate analyses of corms for dry matter, starch, crude protein, total sugars and oxalates were done using standard procedures. Dry matter, crude protein, crude fibre and oxalates were determined by the method of AOAC (2005). The total sugar and starch content was determined by the method of Dubois et al. (1956). The mineral composition of corms like P (Jackson, 1973), K, Ca (Piper, 1970), Mg, Fe, Mn and Zn contents (Lindsay and Norwell, 1978) were also estimated as per standard methods. The P content of corms was determined by the method of colorimetry, K and Ca by flame photometry, Mg, Fe, Mn, Zn and Cu by direct reading in atomic absorption spectrophotometer.

Statistical analysis

The experimental data were analysed statistically using SAS (2010) by applying the technique of analysis of variance (ANOVA) for RBD in the case of on-station experiment and split plot design for on-farm trial.

Results and Discussion

Biochemical composition

The on-station experiments done for two consecutive years indicated that there was no significant difference among the various management practices for biochemical composition of corms, implying the almost equal efficiency of conservation agriculture with that of existing conventional or farmers practices.

The above result was also established in the on-farm trial, where the conservation practice remained on par with farmer's practice. However, as expected, varieties varied significantly for biochemical constituents, especially starch and total sugar contents. The variety Gajendra outperformed the rest of the varieties with significantly higher starch, total sugar and crude fibre contents. The effect of varieties x practices interaction significantly influenced the starch, crude protein, sugar and oxalate contents. Intercropping Gajendra var. and following either of the practice, CA or FP and Sree Padma raised under farmer's practice resulted in corms with higher starch and sugar contents. The local variety also responded better to conservation practice by producing corms with higher sugar content. Irrespective of practices, all the varieties, except Sree Athira under CA, produced corms with higher crude protein content. The oxalate content was significantly the lowest in var. Sree Padma under CA and var. Gajendra under FP.

Nutritional quality is predominantly controlled by genetic and physiological factors. It is the complex result of a range of exogenous factors, including variety, location, fertilization and weather conditions during crop growth.

Table 5. Effect of conservation vs conventional vs organic practices on biochemical constituents of corms of elephant foot yam

Treatments	Dry matter (%)		Starch		Crude protein (% FW basis)		Total sugar		Crude fibre		Oxalate (% DW basis)	
	2014-15	2015-16	2014-15	2015-16	2014-15	2015-16	2014-15	2015-16	2014-15	2015-16	2014-15	2015-16
Conservation organic	20.11	19.47	17.12	16.59	2.19	2.60	1.65	1.16	1.65	1.45	0.084	0.079
Conservation chemical	21.28	19.35	17.92	15.41	2.31	2.72	1.45	1.08	1.30	1.38	0.076	0.091
Conventional chemical	19.78	19.40	16.82	17.69	2.12	2.57	1.33	1.06	1.75	1.60	0.102	0.071
Conventional (POP) (control)	19.78	19.51	17.78	17.00	2.15	2.56	1.50	1.54	1.90	1.40	0.099	0.058
Organic package	20.73	20.89	17.58	17.02	2.22	2.70	2.02	1.17	1.35	1.71	0.065	0.083
S. Em ±	0.665	0.949	0.751	1.368	0.665	0.949	0.193	0.229	0.227	0.075	0.010	0.008
CD (0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Table 6. Effect of conservation vs farmer's practices on the biochemical constituents of corms of elephant foot yam

Treatments	Dry matter	Starch	Crude protein	Sugar	Crude fibre	Oxalate
	%		(% FW basis)			(% DW basis)
Varieties						
Gajendra	22.14	20.87	3.53	1.99	1.83	0.033
Sree Padma	22.95	17.73	3.16	1.51	1.55	0.030
Sree Athira	20.25	14.93	2.75	1.02	1.58	0.046
Peerumade Local	18.66	14.35	3.64	1.74	1.46	0.048
S. Em ±	1.145	0.958	0.250	0.075	0.059	0.006
CD (0.05)	NS	3.315	NS	0.157	0.205	NS
Practices						
Conservation Agriculture (CA)	20.41	17.16	3.06	1.48	1.57	0.040
Farmers Practice (FP)	21.59	16.79	3.25	1.66	1.65	0.038
S. Em ±	0.584	0.568	0.084	0.058	0.094	0.003
CD (0.05)	NS	NS	NS	NS	NS	NS
Varieties x practices						
Gajendra CA	21.12	21.48	3.13	2.17	1.67	0.045
Gajendra FP	23.17	20.27	3.58	1.87	2.00	0.020
Sree Padma CA	23.42	17.03	3.16	1.19	1.63	0.022
Sree Padma FP	22.47	18.44	3.15	1.84	1.46	0.038
Sree Athira CA	19.50	13.43	2.29	0.74	1.50	0.047
Sree Athira FP	21.00	16.43	3.21	1.30	1.67	0.046
Peerumade Local CA	17.60	16.68	3.68	1.86	1.47	0.045
Peerumade Local FP	19.71	12.02	3.05	1.62	1.47	0.050
S. Em ±	1.41	1.25	0.280	0.111	0.145	0.008
CD (0.05)	NS	3.828	0.892	0.336	NS	0.024

However, nutritional quality also includes the absence of harmful compounds, which is certainly determined by the management options (Neuhoff et al., 2011). Analysis of the corm biochemical attributes in the present study indicated that there was no significant difference in the biochemical composition of corms in the various management systems. Similar results of almost identical nutritional quality response under organic and conventional management was reported earlier in elephant foot yam (Suja et al., 2016), and taro (Suja et al., 2017) and quality parameters of tea manufactured from different farming systems, including organic system (Radhakrishnan et al., 2006). This may be due to the fact that regardless of whether the nutrients are from organic or inorganic source, plants absorb the same as inorganic ions and once absorbed the nutrients are re-synthesized into compounds that determine the quality of the produce, which is predominantly the function of genetic makeup of the plants (Chhonkar, 2008).

Mineral composition

The various management options tested on-station significantly influenced Ca, Mg and Cu contents of corms. However, the effect was not consistent between years as Ca and Cu contents in the first year and Mg content in the second year were only significantly influenced. The content of all other minerals remained the same under different practices, indicating that conservation agriculture can be considered as an alternative to conventional POP and organic package. The Ca content of corms produced in conservation chemical plots was higher and on par with the existing organic package. In the case of Mg content, conservation organic proved significantly superior. The Cu content of organically produced corms was significantly higher, followed by conservation organic.

In the on-farm validation trial, the effect of varieties, practices and varieties x practices interaction did not

Table 7. Effect of conservation vs conventional vs organic practices on mineral composition of corms of elephant foot yam (mg $100g^{-1}$ DW basis)

Treatments	P		K		Ca		Mg		Fe		Mn		Zn		Cu	
	2014-15	2015-16	2014-15	2015-16	2014-15	2015-16	2014-15	2015-16	2014-15	2015-16	2014-15	2015-16	2014-15	2015-16	2014-15	2015-16
Conservation organic	242.5	280	1413	1561	72.5	74.1	153.6	236.4	66.5	80.8	6.9	6.2	12.2	9.5	0.90	1.3
Conservation chemical	213.5	282	1395	1954	86.9	73.0	175.6	146.2	44.2	93.9	5.4	8.1	12.8	8.2	0.67	1.3
Conventional chemical	236.2	332	1503	1426	68.0	68.0	174.4	140.8	35.2	87.8	5.1	9.9	12.9	11.1	0.78	1.3
Conventional (POP) (control)	212.3	304	1427	1903	74.2	72.9	155.8	77.4	30.4	110.2	4.2	8.5	7.8	7.0	0.80	1.3
Organic package	253.9	310	1346	1554	84.8	70.0	161.6	152.4	40.2	84.2	5.9	6.4	4.8	5.4	1.33	1.5
S. Em ±	16.87	30.7	133.1	155.4	3.45	6.20	17.52	29.41	14.84	13.30	0.604	1.34	3.55	1.48	0.134	0.072
CD (0.05)	NS	NS	NS	NS	10.64	NS	NS	64.09	NS	NS	NS	NS	NS	NS	0.291	NS

Table 8. Effect of conservation vs farmer's practice on the mineral composition of corms of elephant foot yam

Treatments	P	K	Ca	Mg	Fe	Mn	Zn	Cu
	mg $100g^{-1}$ DW basis							
Varieties								
Gajendra	275.1	859	184	184.1	89.7	3.23	9.28	1.21
Sree Padma	300.6	1121	118	179.1	95.1	3.23	8.59	1.29
Sree Athira	324.5	1361	147	221.7	80.5	3.84	9.42	1.46
Peerumade Local	303.2	985	191	221.1	89.2	3.65	10.66	1.37
S. Em ±	19.42	87.7	17.7	10.69	5.43	0.298	0.66	0.107
CD (0.05)	NS	NS	NS	NS	NS	NS	NS	NS
Practices								
Conservation Agriculture (CA)	304.9	1191	162	216.3	91.3	3.73	10.61	1.20
Farmers Practice (FP)	296.8	972	158	186.7	86.0	3.25	8.37	1.46
S. Em ±	13.66	40.80	17.20	6.32	5.74	0.253	0.468	0.117
CD(0.05)	NS	NS	NS	NS	NS	NS	NS	NS
Varieties x practices								
Gajendra CA	283.1	898	252	209.0	96.2	2.99	11.25	1.63
Gajendra FP	267.2	820	116	159.2	83.2	3.47	7.31	0.793
Sree Padma CA	305.9	1162	106	196.7	98.4	3.39	9.35	1.11
Sree Padma FP	295.3	1080	129	161.5	91.8	3.07	7.83	1.47
Sree Athira CA	316.5	1552	102	237.7	86.0	4.32	10.71	1.68
Sree Athira FP	332.4	1170	192	205.7	75.0	3.36	8.13	1.24
Peerumade Local CA	314.2	1150	185	221.8	84.0	4.21	11.13	1.44
Peerumade Local FP	292.2	859	197	220.3	94.0	3.09	10.19	1.31
S. Em ±	27.39	104.90	30.00	13.94	9.77	0.465	0.935	0.197
CD (0.05)	NS	NS	NS	NS	NS	NS	1.525	NS

significantly affect the mineral content of corms, except Zn content, indicating that conservation agriculture can serve as a substitute to the practice followed by the farmer presently, wherein large quantities of organic manures and bio-resources are applied conjointly with chemical fertilizers injudiciously, which should be avoided. All the varieties, except Sree Padma, raised under conservation practice produced corms with higher Zn content. However, the local var. Peerumade responded well with high content of Zn in the farmers practice, owing to super-optimal addition of organic manures and inorganic fertilizers than required. It is concluded that conservation agriculture is a safe alternative to the existing practices in elephant foot yam as the bio-chemical and mineral contents were not significantly altered.

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