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Research Article

TILLAGE AND NUTRITION FOR QUALITY ENHANCEMENTIN TANNIA (*Xanthosoma sagittifolium* (L.). Schott)

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Abstract: A field investigation was carried out at Instructional farm attached to College of Agriculture, Vellayani, Kerala during 2015-16 to study the effect of tillage and nutrition for quality enhancement in tannia. The experiment was in split plot design with four replications. The treatments consisted of tillage and planting systems as main plot treatments (I_1 - conventional tillage followed by pit system, I_2 -conventional tillage followed by mound system, I_3 - deep tillage followed by pit system and I_4 - deep tillage followed by mound system). The sub plot treatments were soil conditioners (s_1- control, s_2- coir pith, s_3- rice husk) combined with two nutrition systems (n_1- integrated nutrient management (INM) and n_2- organic nutrition). Results of the experiment revealed that the quality characters of tannia was improved by deep tillage with pit system of planting, application of coir pith as soil conditioner @ 500g plant^{-1} and organic nutrition (FYM @37.5 t ha^{-1} + wood ash @ 2 tha^{-1}).

Keywords: *Nutrition, Xanthosoma, Coir pith, Tillage, Quality*

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Introduction

Tannia (*Xanthosoma sagittifolium* (L.). Schott), also known as new cocoyam is an herbaceous, monocotyledonous crop that belongs to Araceae family. Tannia is one of the most important tuber crops grown in the world [1]. The stem is an underground structure which is rich in starch and is called as 'corm' and from this off shoots (cormels) develop. The corm, cormels and foliage of tannia are an important source of carbohydrates, vitamins and minerals for human nutrition and animal feed [2]. The cormels and leaves are eaten after cooking [3]. The tubers are considered to be more nutritious than potato [4]. Flowering is rare in tannia. The marginalization in agricultural policies combined with research interventions might be the reason why cultivation of this crop is largely in the hands of resource poor rural farmers. Although tannia grows up well in a wide variety of soil, higher variation in yield has been observed when it is grown in different soil types. In Kerala, tannia is grown in the homesteads and also in the coconut gardens. But the crop is still under-exploited compared to other tuber crops even though tannia ranks third in importance after cassava and yam [5, 6]. Hence the present study is undertaken to identify ideal tillage system, soil conditioner and nutrient management for quality enhancement in tannia.

Materials and Methods

The field experiment was conducted at College of Agriculture, Vellayani, Thiruvananthapuram, Kerala during 2015-16. Vellayani has a warm and humid tropical climate. The soil of the experimental site was sandy clay loam with a pH of 5.7. The soil was high in organic carbon and available P, low in available N and medium in available K. The experiment was taken in split plot design. The four main treatments were conventional tillage followed by pit system (I1), conventional tillage followed by mound system (I2), deep tillage followed by pit system(I3) and deep tillage followed by mound system (I4). The sub plot treatments were three soil conditioners (s_1- control, s_2- coirpith, s_3- rice husk) combined with two nutrient management systems (n_1- integrated nutrient management (INM) and n_2- organic nutrition). The soil conditioners were applied @ 500g per plant.

The integrated management system involved application of farm yard manure (FYM) @ 25 tha^{-1} + 80:50:150 kg NPK ha^{-1}. Organic nutrition comprised of FYM @37.5 t ha^{-1} + wood ash @ 2 t ha^{-1}. Dolomite @ 1 t ha^{-1} was applied uniformly to all plots at land preparation. The land was prepared as per the treatments and sprouted corm pieces (weighing about 80g)were used for planting. The crop was planted during May 2015 at a spacing of 0.75 m x 0.75 m. Intercultural operations and earthing up were done along with top dressing of fertilizers at 2, 4 and 6 months after planting. The crop was harvested by February 2016.

The dry matter production was recorded after harvest. The sample plants were uprooted and separated into leaf blade and petiole, corm and cormels. Sub samples were taken for estimating the dry weight after recording fresh weight of each part. The sub samples were dried in a hot air oven until constant dry weight was reached. The dry weight of each part was worked out and total dry matter production (TDMP) was computed in t ha^{-1}. Harvest index was also worked out from the observational plants. Starch content of cormel was estimated by using potassium ferri cyanide method [7]. Protein content (%) of cormel on dry weight basis was calculated by multiplying N content (%) in cormel with 6.25[8]. Samples of cormels weighing 100 g each taken from each treatment were spread on floor over newspaper under ambient conditions and observed for shelf life. The cormels were observed daily for sprouting and decay. The weight of samples was recorded once in three days to calculate physiological loss in weight (PLW) using the formula as given below.

$$PLW\ (\%) = ((\text{Initial weight} - \text{Final weight}))/(\text{Initial weight}) \times 100$$

Results and Discussion

Total Dry Matter Production

[Table-1a] reveal the significant effects of treatments on total dry matter production. Among tillage systems, deep tillage with pit system of planting (I3) was found to dominate in producing higher dry matter production (5.94 t ha^{-1}). This was followed by deep tillage with mound system of planting (I4). Deep tillage registered significantly higher total dry matter production over conventional tillage.

Pit system was found to be superior over mound system in TDMP as revealed from contrast analysis. Application of soil conditioner had recorded significant effects over control (s_1). Among soil conditioners, coir pith (s_2) was superior (5.08 t ha^{-1}) to rice husk (s_3) as soil conditioner. After the investigation, organic nutrition (n_2) proved its superiority in its effect on TDMP (5.13 t ha^{-1}) over INM (n_1). Similar results were obtained in tannia [9] where organic nutrition was found to favour effective partitioning of assimilates to cormels resulting in higher tuber yield. None among the interactions I x s, I x n and s x n [Table-1b] had significant effects on TDMP. The treatment combinations I_3s_3 (4.86 t ha^{-1}), I_3n_2 (4.95 t ha^{-1}) and s_2n_2 (4.43 t ha^{-1}) were found superior. The interaction I x s x n was not found to be significant.

Harvest Index

All the tillage systems except conventional tillage followed by mound system (I2) were found on a par in their effects on harvest index. Contrast analysis has revealed that deep tillage is superior to conventional tillage and pit system is found to be dominant over mound system of planting. The application of soil conditioner significantly increased the harvest index and the effects of coir pith (s_2) and rice husk (s_3) were found to be on a par. Organic nutrition (n_2) registered the higher harvest index (0.35) compared to INM (n_1). Among the interactions [Table-1b], only I x s had significant effect on harvest index. The treatment combination I_3s_2 was found superior (0.40) in its effect on harvest index. Similar to TDMP, the treatment combination I_3n_2 recorded the highest harvest index of 0.39 and the treatment combination s_2n_2 dominated with 0.36 harvest index even though the effects were not significant. The treatment combination $I_3s_2n_2$ registered the highest harvest index of 0.41 even though the effect of I x s x n interaction [Table-1c] was not significant.

Table-1a *Effect of tillage systems, soil conditioners and nutrient management on total dry matter production (TDMP) and harvest index [S- Significant]*

Treatments	TDMP (t ha^{-1})	Harvest index
Tillage systems (I)		
I_1- Conventional tillage- pit system	4.68	0.34
I_2- Conventional tillage-mound system	3.98	0.29
I_3- Deep tillage-pit system	5.94	0.38
I_4 - Deep tillage-mound system	5.14	0.36
SEm±	0.017	0.002
CD (0.05)	0.062	0.008
Contrast analysis- Conventional vs Deep tillage		
Conventional tillage	4.33	0.32
Deep tillage	5.54	0.37
F test	S	S
Contrast analysis – Pit vs Mound system of planting		
Pit system	5.31	0.36
Mound system	4.56	0.33
F test	S	S
Soil conditioners (s)		
s_1- Control	4.79	0.33
s_2- Coir pith	5.08	0.35
s_3- Rice husk	4.93	0.35
SEm±	0.008	0.003
CD (0.05)	0.024	0.008
Nutrient management (n)		
n_1- INM	4.73	0.33
n_2- Organic nutrition	5.13	0.35
SEm±	0.007	0.002
CD (0.05)	0.019	0.006

Dry matter content of the cormel

Various tillage systems, soil conditioners and nutrient management had significant influence on dry matter content of cormel [Table-2a]. Deep tillage with pit system of planting (I3) registered significantly higher (29.83%) dry matter content of cormel followed by deep tillage and mound system (I4). The superiority of deep tillage over conventional tillage and pit over mound system of planting was revealed from contrast analysis. Application of soil conditioner resulted in significantly higher content of dry matter in cormel and among them application of coir pith (s_2) was found to be superior (29.30%). Organic nutrition (n_2) resulted in significantly higher dry matter content (29.35%) of cormel than INM (n_1). Interaction effects presented in [Table-2b] indicates that I x s and I x n interaction were not significant. Among S x N interaction, the treatment combination s_2n_2 registered significantly higher (30.88%) dry matter content of cormel. The effect of I x s x n interaction was not significant during the period of study [Table-2c]. However, the treatment combination $I_3s_2n_2$ was found to be higher in the combination.

Table-1b *Interaction effect of tillage systems, soil conditioners and nutrient management on total dry matter production (TDMP) and harvest index [NS- Not significant]*

Treatments	TDMP (t ha^{-1})	Harvest index
I x s interaction		
I_1s_1	3.64	0.33
I_1s_2	3.99	0.34
I_1s_3	3.85	0.34
I_2s_1	3.40	0.29
I_2s_2	3.77	0.29
I_2s_3	3.56	0.29
I_3s_1	4.46	0.37
I_3s_2	4.77	0.40
I_3s_3	4.86	0.38
I_4s_1	3.96	0.35
I_4s_2	4.23	0.37
I_4s_3	4.09	0.37
SEm±	0.055	0.005
CD (0.05)	NS	0.015
I x n interaction		
I_1n_1	3.57	0.33
I_1n_2	4.08	0.34
I_2n_1	3.39	0.28
I_2n_2	3.77	0.30
I_3n_1	4.45	0.37
I_3n_2	4.95	0.39
I_4n_1	3.92	0.36
I_4n_2	4.27	0.37
SEm±	0.044	0.004
CD (0.05)	NS	NS
s x n interaction		
s_1n_1	3.70	0.33
s_1n_2	4.03	0.34
s_2n_1	3.95	0.34
s_2n_2	4.43	0.36
s_3n_1	3.84	0.33
s_3n_2	4.34	0.36
SEm±	0.038	0.004
CD (0.05)	NS	NS

Table-1c *Effect of I x s x n interaction on total dry matter production (TDMP) and harvest index [NS- Not significant]*

Treatments	TDMP (t ha^{-1})	Harvest index
$I_1s_1n_1$	3.41	0.32
$I_1s_1n_2$	3.86	0.33
$I_1s_2n_1$	3.72	0.34
$I_1s_2n_2$	4.25	0.35
$I_1s_3n_1$	3.58	0.33
$I_1s_3n_2$	4.12	0.35
$I_2s_1n_1$	3.21	0.29
$I_2s_1n_2$	3.60	0.29
$I_2s_2n_1$	3.62	0.28
$I_2s_2n_2$	3.92	0.30
$I_2s_3n_1$	3.34	0.28
$I_2s_3n_2$	3.78	0.30
$I_3s_1n_1$	4.33	0.35
$I_3s_1n_2$	4.60	0.38
$I_3s_2n_1$	4.46	0.39
$I_3s_2n_2$	5.07	0.41
$I_3s_3n_1$	4.56	0.36
$I_3s_3n_2$	5.16	0.39
$I_4s_1n_1$	3.87	0.35
$I_4s_1n_2$	4.05	0.36
$I_4s_2n_1$	4.04	0.37
$I_4s_2n_2$	4.46	0.37
$I_4s_3n_1$	3.89	0.37
$I_4s_3n_2$	4.28	0.38
SEm±	0.077	0.008
CD (0.05)	NS	NS

Starch content of the cormel

Data from [Table-2a] depicts that the main effects of treatments werefound to be significant. Deep tillage with pit system of planting (l3) registered the highest content of starch (75.08%) in cormel followed by deep tillage with mound system (l4). Similar to cormel dry matter, contrast analysis indicated the superiority of deep tillage over conventional tillage and pit system of planting over mound system. Coir pith when used as a soil conditioner (s_2) registered significantly higher starch content (69.76%) than control (s_1) and rice husk as soil conditioner (s_3). Organic nutrition (n_2) recorded significantly higher starch content (69.04%) during the period of study. This is in confirmation with various studies in elephant foot yam, where there was improvement in tuber quality due to organic nutrition [10-14]. Similar results were also reported in yams [13-15]. Considering the effect of l x s interaction [Table-2b], the treatment combination l_3s_2 recorded significantly higher (77.07%) content of starch in cormel. Regarding l x n interaction, the treatment combination l_3n_2 registered the highest content of starch (75.71%) even though the effects were not significant. Among s x n interaction there was no significant interaction among the treatments, however, the treatment combination, s_2n_2 (70.68%) produced higher content of starch. The interaction l x s x n [Table-2c] failed to produce any significant effect of starch content.

Protein Content

Similar to cormel dry matter and starch, the main effects of treatments on protein content of cormel were significant [Table-2a]. Deep tillage followed by pit system (l3) produced significantly higher protein content (7.66%). Contrast analysis revealed the superiority of deep tillage over conventional tillage and pit system over mound system of planting. Coir pith (s_2) was superior to rice husk (s_3) as soil conditioner and control (s_1) in its effect on protein content. As in the case of dry matter and starch contents, organic nutrition (n_2) resulted in significantly higher content of protein in the cormel during the period of study (7.50%) compared to INM (n_1). Tannia leaves and petioles present greater quantity of proteins, fibres, calcium, magnesium and Vitamin C than some conventional plants [16].

As shown in [Table-2b], l x s interaction had significant effects on protein content with the treatment combinations, l_3s_2, l_3s_3, l_4s_2 and l_1s_3 being on par. Although l x n interaction was not significant, the treatment combination l_3n_2 recorded the highest content of protein. The effects of s x n interaction were observed to be not significant, but the treatment combinations s_2n_2 and s_3n_2 were on a par. The interaction l x s x n had no significant effect on protein content during the period of investigation [Table-2c].

Table-2a *Effect of tillage systems, soil conditioners and nutrient management on quality characters of cormel, % [S- Significant]*

Treatments	Cormel dry matter content	Starch content	Protein
Tillage systems (l)			
l_1- Conventional tillage- pit system	27.48	64.98	7.33
l_2- Conventional tillage-mound system	26.57	62.08	6.78
l_3- Deep tillage-pit system	29.83	75.08	7.66
l_4 - Deep tillage-mound system	28.61	71.10	7.40
SEm±	0.302	0.134	0.070
CD (0.05)	1.118	0.496	0.259
Contrast analysis- Conventional vs Deep tillage			
Conventional tillage	27.03	63.53	7.06
Deep tillage	29.22	73.09	7.53
F test	S	S	S
Contrast analysis – Pit vs Mound system of planting			
Pit system	28.66	70.03	7.50
Mound system	27.59	66.59	7.09
F test	S	S	S
Soil conditioners (s)			
s_1- Control	26.55	66.96	6.92
s_2- Coir pith	29.30	69.76	7.55
s_3- Rice husk	28.53	68.21	7.41
SEm±	0.237	0.155	0.070
CD (0.05)	0.671	0.439	0.198
Nutrient management (n)			
n_1- INM	26.89	67.59	7.09
n_2- Organic nutrition	29.35	69.04	7.50
SEm±	0.194	0.127	0.057
CD (0.05)	0.548	0.358	0.162

Table-2b *Interaction effect of tillage systems, soil conditioners and nutrient management on quality characters of cormel, % [NS- Not significant]*

Treatments	Cormel dry matter content	Starch	Protein
l x s interaction			
l_1s_1	26.07	63.22	6.78
l_1s_2	28.51	66.60	7.44
l_1s_3	27.87	65.13	7.77
l_2s_1	25.29	61.15	6.35
l_2s_2	27.55	62.77	7.11
l_2s_3	26.88	62.33	6.89
l_3s_1	27.99	74.03	7.55
l_3s_2	31.18	77.07	7.88
l_3s_3	30.32	74.15	7.55
l_4s_1	26.84	69.46	7.00
l_4s_2	29.95	72.62	7.77
l_4s_3	29.03	71.23	7.44
SEm±	0.475	0.310	0.140
CD (0.05)	NS	0.878	0.396
l x n interaction			
l_1n_1	25.86	64.20	7.07
l_1n_2	29.11	65.77	7.59
l_2n_1	25.46	61.66	6.71
l_2n_2	27.69	62.51	6.86
l_3n_1	28.81	74.45	7.37
l_3n_2	30.85	75.71	7.95
l_4n_1	27.45	70.05	7.22
l_4n_2	29.77	72.16	7.59
SEm±	0.388	0.253	0.114
CD (0.05)	NS	NS	NS
s x n interaction			
s_1n_1	26.10	66.16	6.78
s_1n_2	26.99	67.77	7.06
s_2n_1	27.72	68.85	7.39
s_2n_2	30.88	70.68	7.71
s_3n_1	26.86	67.75	7.11
s_3n_2	30.19	68.67	7.71
SEm±	0.336	0.219	0.099
CD (0.05)	0.949	NS	NS

Table-2c *Effect of l x s x n interaction on quality characters of cormel, % [NS- Not significant]*

Treatments	Cormel dry matter content	Starch	Protein
$l_1s_1n_1$	25.32	62.52	6.78
$l_1s_1n_2$	26.82	63.93	6.78
$l_1s_2n_1$	26.35	65.42	7.22
$l_1s_2n_2$	30.67	67.78	7.66
$l_1s_3n_1$	25.90	64.66	7.22
$l_1s_3n_2$	29.85	65.61	8.32
$l_2s_1n_1$	24.96	60.48	6.35
$l_2s_1n_2$	25.63	61.82	6.35
$l_2s_2n_1$	26.03	62.50	7.00
$l_2s_2n_2$	29.06	63.03	7.22
$l_2s_3n_1$	25.40	61.99	6.78
$l_2s_3n_2$	28.37	62.68	7.00
$l_3s_1n_1$	27.59	73.05	7.22
$l_3s_1n_2$	28.40	75.01	7.88
$l_3s_2n_1$	29.88	76.28	7.66
$l_3s_2n_2$	32.48	77.87	8.10
$l_3s_3n_1$	28.97	74.03	7.22
$l_3s_3n_2$	31.68	74.27	7.88
$l_4s_1n_1$	26.55	68.60	6.78
$l_4s_1n_2$	27.13	70.32	7.22
$l_4s_2n_1$	28.61	71.20	7.66
$l_4s_2n_2$	31.30	74.05	7.88
$l_4s_3n_1$	27.20	70.34	7.22
$l_4s_3n_2$	30.87	72.12	7.66
SEm±	0.671	0.439	0.198
CD (0.05)	NS	NS	NS

Shelf Life

After harvest, the cormels were arranged over newspaper and spread on floor. No decay of cormel was observed upto 45th day of storage.

Table-3a *Effect of tillage systems, soil conditioners and nutrient management on physiological loss in weight of cormel after 45 days of storage, % [S- Significant]*

Treatments	Physiological loss in weight
Tillage systems (l)	
l_1- Conventional tillage- pit system	15.91
l_2- Conventional tillage-mound system	17.77
l_3- Deep tillage-pit system	14.47
l_4 - Deep tillage-mound system	15.76
SEm±	0.043
CD (0.05)	0.161
Contrast analysis- Conventional vs Deep tillage	
Conventional tillage	16.84
Deep tillage	15.11
F test	S
Contrast analysis – Pit vs Mound system of planting	
Pit system	15.19
Mound system	16.76
F test	S
Soil conditioners (s)	
s_1- Control	16.19
s_2- Coir pith	15.88
s_3- Rice husk	15.87
SEm±	0.033
CD (0.05)	0.094
Nutrient management (n)	
n_1- INM	16.12
n_2- Organic nutrition	15.83
SEm±	0.027
CD (0.05)	0.077
	S- Significant

Table-3b *Interaction effects of tillage systems, soil conditioners and nutrient management on physiological loss in weight of cormel after 45 days of storage, % [NS- Not significant]*

Treatments	Physiological loss in weight
l x s interaction	
l_1s_1	16.10
l_1s_2	15.79
l_1s_3	15.84
l_2s_1	17.99
l_2s_2	17.60
l_2s_3	17.71
l_3s_1	14.56
l_3s_2	14.41
l_3s_3	14.43
l_4s_1	16.09
l_4s_2	15.70
l_4s_3	15.48
SEm±	0.066
CD (0.05)	0.187
l x n interaction	
l_1n_1	16.05
l_1n_2	15.77
l_2n_1	17.89
l_2n_2	17.65
l_3n_1	14.53
l_3n_2	14.41
l_4n_1	16.02
l_4n_2	15.50
SEm±	0.054
CD (0.05)	0.153
s x n interaction	
s_1n_1	16.33
s_1n_2	16.05
s_2n_1	16.02
s_2n_2	15.74
s_3n_1	16.02
s_3n_2	15.71
SEm±	0.047
CD (0.05)	NS

Sprouting of cormels started from 32nd day. About 50% sprouting was observed on 46th day when observations on shelf life were concluded. 50% sprouting of tubers in the stored samples of coleus within 30 to 40 days of storage irrespective of the treatments was also reported [17]. In coleus sprouting was started after one month of storage and was completed by two months irrespective of treatments [18]. [Table-3a, 3b and 3c] shows the data on physiological loss in weight (PLW) of cormel after 45 days of storage. Tillage systems differed significantly in registering PLW of cormel during storage [Table-3a]. The PLW was minimum (14.47%) after 45 days of storage with deep tillage followed by pit system of planting (l3) and maximum with conventional tillage followed by mound system (l2). The superiority of deep tillage over conventional tillage and pit system over mound system of planting was evident from contrast analysis also. This means that the loss in weight in deep tillage was less compared to conventionally raised plots. The cormels from plots with soil conditioners (s_3 and s_2) recorded the minimum (15.88% and 15.88% respectively) PLW after 45 days of storage [Table-3a]. The plots with organic nutrition (n_2) produced cormels which recorded lower values of PLW after 45 days of storage compared to INM (n_1). This is also confirmed by studies [19] where highest percentage of PLW was observed when the crop received inorganic fertilizers alone. Regarding interaction effects [Table-3b] only l x s and l x n interaction effects were found to be significant. In the case of l x s interaction, the effect of the treatment combination l_3s_2 was found superior (14.41%) to others. With regard to l x n interaction l_3n_2(14.41%) was found to be superior. The treatment l x s x n interaction was not found to be significant.

Table-3c *Effect of l x s x n interaction on physiological loss in weight of cormel after 45 days of storage, % [NS- Not significant]*

Treatments	Physiological loss in weight
$l_1s_1n_1$	18.15
$l_1s_1n_2$	17.84
$l_1s_2n_1$	17.66
$l_1s_2n_2$	17.54
$l_1s_3n_1$	17.86
$l_1s_3n_2$	17.56
$l_2s_1n_1$	16.24
$l_2s_1n_2$	15.96
$l_2s_2n_1$	16.01
$l_2s_2n_2$	15.58
$l_2s_3n_1$	15.91
$l_2s_3n_2$	15.78
$l_3s_1n_1$	16.30
$l_3s_1n_2$	15.89
$l_3s_2n_1$	15.94
$l_3s_2n_2$	15.46
$l_3s_3n_1$	15.81
$l_3s_3n_2$	15.14
$l_4s_1n_1$	14.63
$l_4s_1n_2$	14.50
$l_4s_2n_1$	14.45
$l_4s_2n_2$	14.38
$l_4s_3n_1$	14.50
$l_4s_3n_2$	14.36
SEm±	0.094
CD (0.05)	NS

Conclusion

Deep tillage followed by pit system profoundly improved the TDMP and harvest index. The use of a soil conditioner markedly improves the TDMP. Coir pith as soil conditioner is found to improve the TDMP. Harvest index can be increased by using coir pith or rice husk as soil conditioner. Organic nutrition was found superior over INM in its effects on TDMP and harvest index. The quality characters like dry matter, starch and protein contents of cormel were improved by deep tillage followed by pit system along with the application of coir pith as the soil conditioner. Organic nutrition was found superior to INM in influencing quality characters. The present study revealed that cormels of tannia could be stored for one month without any microbial decay, sprouting and appreciable PLW. No decay due to microbial attack was observed up to 45 days of storage under ambient conditions. To conclude, the quality characters of tannia can be improved widely by deep tillage to a depth of 30 cm followed by pit system of planting, application of coir pith as soil conditioner @ 500g plant^{-1} and organic nutrition (FYM @ 37.5 t ha^{-1} + wood ash @ 2 t ha^{-1}).

Application of research: The tannia farmers face the problem of yield stability every year. The effect of deep tillage combined with use of a suitable soil conditioner along with organic management is necessary for quality production in tannia.

Research category: Quality enhancement

Abbreviations: TDMP: Total dry matter production, PLW: Physiological loss in weight

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Study area / Sample Collection: College of Agriculture, Vellayani, Thiruvananthapuram, 695522, Kerala, India

Cultivar / Variety / Breed name: Tannia (*Xanthosoma sagittifolium* (L.). Schott)

Conflict of Interest: None declared

Ethical approval: This article does not contain any studies with human participants or animals performed by any of the authors.
Ethical Committee Approval Number: Nil

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