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Effect of organic, inorganic and bio-fertilizers on yield and quality of Thuduvalai (*Solanum trilobatum* L.)

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Abstract
A field experiment was conducted at Annamalai University on Integrated nutrient management on growth and yield of thuduvalai. Randomized Block Design with three replication was adopted in thuduvalai and the inorganic sources viz., nitrogen, phosphorous and potassium. The organic sources i.e. Farmyard manure, vermicompost, coirpith compost and neem cake, Panchagavya and biofertilizers. The results showed application of 50% NPK (50:30:20 kg ha^{-1}) + VC (2.5 t ha^{-1}) + BF @ 2 kg ha^{-1} + PG @ 3% foliar spray to thuduvalai had significant effect on yield and quality.

Keywords: nutrient, organic, inorganic, FYM, panchagavya and thuduvalai

1. Introduction
Thuduvalai (*Solanum trilobatum* L.) belongs to the family Solanaceae. In this crop have a thorny creeper with bluish violet flower, mostly grown in tropical areas which commonly available in southern India and it has been used traditional in siddha system of medicine. The leaves are very effective in neutralizing excess heat, relieves from sore throat, cough and cold and also gas trapped in body.In medicine of siddha these leaves are called as long life elixir. They stimulates blood production, prevents thickening of blood,increases blood flow. The active principle in this herb is solasodine, diosogenin, sobatum, solaine and tomatidine (Mohanan and Devi, 1996) [6].

In *Ocimum sanctum*, Sivasankar (2005) [5] revealed that the treatment combination of biodynamic compost @ 5 t ha^{-1} with 100 per cent recommended dose of fertilizers (120:60:60 kg NPK ha^{-1}) produce the highest total herb yield (68.32 t ha^{-1}). Sharmila *et al*. (2005) [4] reported that among the various treatments, the treatment comprising 60:60:10 kg of NPK ha^{-1} along with 2 kg each *Azospirillum* and Phosphobacteria recorded the maximum values for growth, herbage and oil yield in *Mentha arvesis* and *Mentha citrate*. In periwinkle, application of recommended dose of NPK (100:50:50 kg ha^{-1}) with *Azospirillum* and Phosphobacteria @ 2 kg ha^{-1} was found to improve the growth parameters (Sendhilnathan and Karuppaiah, 2008) [3].

Materials and methodology
Field experiments were conducted at Faculty of Horticulture, Annamalai University, Annamalai Nagar, Chidambaram. The experiments were laid out in a randomized block design with thirteen treatments replicated thrice. The data were subjected to statistical analysis as suggested by Panse and Sukhatme, 1985. The treatment schedule was as follows.

Inorganic	Organic	Biofertilizers	Foliar spray
100 % RDF 75 % RDF 50 % RDF	FYM Vermicompost Coir pith compost Neem cake	*Azospirillum* Phosphobacteria	Panchagavya

The experimental plot was ploughed with a tractor and levelled after passing a disc harrow. The clods were crushed, weeds were removed later than and bunds and channels were prepared. Thirty nine plots of 1.30 x 1.90 m were formed. The inorganic nutrients were applied in the form of nitrogen was applied as urea, phosphorus was applied as single super phosphate, while potassium was applied as muriate of potash.

Half dose of nitrogen, full dose of phosphorus and potassium were applied as basal dose and the remaining half dose of nitrogen was applied in 90 DAT. As per the treatment application of organic manures along with the biofertlizer like *Azospirillum* and Phosphobacteria were applied before planting. The required quantity of panchagavya were taken, dissolve in water and given as foliar application as per the treatment. The spray was given at 60, 90 and 120 DAT.

Result and Discussion

It can be inferred from the data tabulated in table (2) that there were significant differences among the various treatment with regard to leaf yield g per plant, leaf yield g per plot and leaf yield g per hectare. The leaf yield was maximum (209.63 g plant^{-1}, 1.88 kg plot^{-1} and 10.35 t ha^{-1}) in the treatment (T_6). The increase in growth parameters due to application of vermicompost may be due to the presence of growth substances, nitrogen fixers, other essential nutrients and also due to higher phosphorus by a symbiotic mycorrhizal association as reported by (Bano *et al.*, 1987) [1]. Incorporation of vermicompost promotes the lush growth of plants which may be due to the presence of plant growth promoters like auxins and cytokinins in vermicompost (Radha *et al.*, 1986) [2], which are responsible for cell division and cell elongation. It can be inferred from the data tabulated in table (2) that there were significant differences among the various treatments with regard to dry matter production. The dry matter production was maximum (193.23 g plant^{-1}) in the treatment T_6. This was due to positive role played by nutrients on growth and metabolic of plants, which increased the accumulation of dry matter in the plant. Organic manure might have provided a continuous supply of nutrients and might have enabled the leaf area duration to extend, thus providing an opportunity for the plants to increase the photosynthetic rates, which could have led to the higher accumulation of dry matter. In addition, the beneficial effect of *Azospirillum* in fixing the atmosphere nitrogen and also its involvement in the release of phytohormones could have increased the plant growth, resulting in higher dry matter production. Similar findings were also reported by Harisha *et al*. (2010) in garden cress.

There was significant differences among the treatments. The highest solasodine content (1.63 %) was recorded in T_6 and it was followed by T_3 which registered a value of 1.62 % and this was on par with the treatment T_{10}. The solasodine content was minimum in the treatment T_{13} (control) which was registered 1.44 per cent respectively. The possible reasons for the acceleration in solasodine content due to application of optimum dose of fertilizers might be attributed to the higher dry matter production which would have invariably determined the alkaloid content as it required metabolites to the filling sink. Further, the enhanced dry matter production would also have invariably determined the alkaloid content. Higher availability and uptake of nutrients would have enhanced the higher photosynthetic activity and accumulation of photosynthates at the sink, which in turn, correspond to the higher amounts of alkaloids. Similar findings were also reported by Pundarikakshudu *et al*. (2003) [9] in *Solanum xanthocarpum.*

It was observed that the treatment T_6 [50% NPK (50:30:20 kg ha^{-1}) + Vermicompost (2.5 t ha^{-1}) + Biofertilizers (*Azospirillum* and Phosphobacteria each @ 2 kg ha^{-1})] + Panchagavya @ 3% foliar spray at 60, 90 and 120 DAT recorded the highest gross income (Rs 103510), net income (Rs 64404) and return per rupee invested (2.64). Any technology should be technically feasible and economically viable to reach the farmers field. Therefore, economic analysis of the results is vey important. In the study, it was observed that application of 50 per cent NPK (50:30:20 kg ha^{-1}) + Vermicompost (2.5 t ha^{-1}) + Biofertilizers (*Azospirillum* and Phosphobacteria each @ 2 kg ha^{-1}) + Panchagavya @ 3 per cent foliar spray at 60, 90 and 120 DAT recorded the maximum gross return of Rs. 1,03,510 ha^{-1} and benefit cost ratio of 2.34 when compared to the other treatment combination. The increase net profit and benefit:cost ratio in this treatment was mainly due to the precise management practices followed throughout the cropping period and their much pronounced effect in registering higher yield.

Table 1: Effect of integrated nutrient management on green leaf yield (g plant^{-1}), leaf yield (kg plot^{-1}) and estimated leaf yield (t ha^{-1}) in Thuduvalai (*Solanum trilobatum* L.)

Treatments	Leaf yield (g plant^{-1})	Leaf yield (kg plot^{-1})	Estimated Leaf yield (t ha^{-1})	Dry matter production (g)
T_1 - 100% NPK (100:60:40 kg ha^{-1}) + FYM (25 t ha^{-1})	181.97	1.64	8.98	185.30
T_2 - 75% NPK (75:45:30 kg ha^{-1}) + FYM (25 t ha^{-1}) +BF @ 2 kg ha^{-1}	114.84	1.03	5.67	166.22
T_3 - 50% NPK (50:30:20 kg ha^{-1}) + FYM (25 t ha^{-1}) + BF @ 2 kg ha^{-1} + PG @ 3% foliar spray	198.67	1.78	9.63	190.03
T_4 - 100% NPK (100:60:40 kg ha^{-1}) + VC (2.5 t ha^{-1})	170.30	1.53	8.40	182.11
T_5 - 75% NPK (75:45:30 kg ha^{-1}) + VC (2.5 t ha^{-1}) + BF @ 2 kg ha^{-1}	141.42	1.27	6.98	174.49
T_6 - 50% NPK (50:30:20 kg ha^{-1}) + VC (2.5 t ha^{-1}) + BF @ 2 kg ha^{-1} + PG @ 3% foliar spray	209.63	1.88	10.35	193.23
T_7 - 100% NPK (100:60:40 kg ha^{-1}) + CP (5 t ha^{-1})	130.89	1.17	6.46	171.03
T_8 - 75% NPK (75:45:30 kg ha^{-1}) + CP (5 t ha^{-1}) + BF @ 2 kg ha^{-1}	104.35	0.93	5.15	162.27
T_9 - 50% NPK (50:30:20 kg ha^{-1}) + CP (5 t ha^{-1}) + BF @ 2 kg ha^{-1} + PG @ 3% foliar spray	153.39	1.38	7.57	177.49
T_{10} - 100% NPK (100:60:40 kg ha^{-1}) + NC (2.5 t ha^{-1})	193.31	1.73	9.54	188.61
T_{11} - 75% NPK (75:45:30 kg ha^{-1}) + NC (2.5 t ha^{-1}) + BF @ 2 kg ha^{-1}	125.47	1.12	6.19	169.51
T_{12} - 50% NPK (50:30:20 kg ha^{-1}) + NC (2.5 t ha^{-1}) + BF @ 2 kg ha^{-1} + PG @ 3% foliar spray	158.80	1.42	7.82	178.87
T_{13} - Control	61.02	0.54	3.01	159.78

FYM – Farm yard manure VC – Vermicompost NC – Neem cake

PG – Panchagavya @ 3 % foliar spray CP – Coir pith compost BF – Biofertilizers (Azospirillum and Phosphobacteria each @ 2 kg ha^{-1})

Table 2: Economics analysis for the effect of integrated nutrient management on growth and yield of Thuduvalai (*Solanum trilobatum*)

Treatment details		Estimated leaf yield (t ha^{-1})	Total cost of cultivation (Rs ha^{-1})	Gross income (Rs ha^{-1})	Net benefit (Rs ha^{-1})	Cost benefit ratio
T_1	100% NPK (100:60:40 kg ha^{-1}) + FYM (25 t ha^{-1})	8.98	41998	89860	47862	2.13
T_2	75% NPK (75:45:30 kg ha^{-1}) + FYM (25 t ha^{-1}) + BF @ 2 kg ha^{-1}	5.67	41266	56720	15454	1.37
T_3	50% NPK (50:30:20 kg ha^{-1}) + FYM (25 t ha^{-1}+ BF @ 2 kg ha^{-1} + PG @ 3% foliar spray	9.63	40485	96300	55815	2.37
T_4	100% NPK (100:60:40 kg ha^{-1}) + VC (2.5 t ha^{-1})	8.40	40412	84020	43608	2.07
T_5	75% NPK (75:45:30 kg ha^{-1}) + VC (2.5 t ha^{-1}) + BF @ 2 kg ha^{-1}	6.98	39753	69830	26918	1.75
T_6	50% NPK (50:30:20 kg ha^{-1}) + VC (2.5 t ha^{-1}) + BF @ 2 kg ha^{-1} + PG @ 3% foliar spray	10.35	39106	103510	64404	2.64
T_7	100% NPK (100:60:40 kg ha^{-1}) + CP (5 t ha^{-1})	6.46	42912	64660	21748	1.50
T_8	75% NPK (75:45:30 kg ha^{-1}) + CP (5 t ha^{-1}) + BF @ 2 kg ha^{-1}	5.15	42173	51590	9417	1.22
T_9	50% NPK (50:30:20 kg ha^{-1}) + CP (5 t ha^{-1}) + BF @ 2 kg ha^{-1} + PG @ 3% foliar spray	7.57	41376	75730	34354	1.83
T_{10}	100% NPK (100:60:40 kg ha^{-1}) + NC (2.5 t ha^{-1})	9.54	47912	95410	47498	1.99
T_{11}	75% NPK (75:45:30 kg ha^{-1}) + NC (2.5 t ha^{-1}) + BF @ 2 kg ha^{-1}	6.19	47253	61990	14737	1.50
T_{12}	50% NPK (50:30:20 kg ha^{-1}) + NC (2.5 t ha^{-1}) + BF @ 2 kg ha^{-1} + PG @ 3% foliar spray	7.82	46066	78210	32144	1.69
T_{13}	Control	3.01	25783	30100	4317	1.16

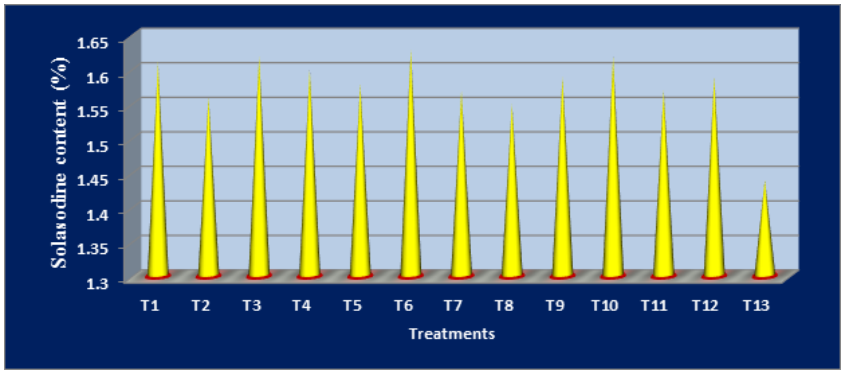

Fig 1: Effect of integrated nutrient management on solasodine content (%) in Thuduvalai (*Solanum trilobatum* L.)

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