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Effect of different organic amendments and fertigation on growth, yield, quality of watermelon (*Citrullus lanatus* Thunb.) and soil properties of Theri land (Red sand dune) of southern Tamil Nadu

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Abstract
The present investigation was carried out at Sattankulam taluk, Thoothukudi district of Tamil Nadu, India to study the effect of different organic amendments with recommended dose of fertilizers on growth and yield of watermelon and physic-chemical properties of *Theri* soil (red sand dunes) during the year 2019 and 2020. The experiment was laid out in Randomized Block Design with Factorial concept (FRBD). In all there were three factors as organic amendments with 6 treatment combinations for each factor, which were assigned at random in each plots with three replications. The recommended dose of fertilizers in treatments were two levels as 75 and 100 percent. Among the treatment combinations, the tank silt application @ 100 t ha^{-1} with 100 percent recommended fertilizer as 200:100:100 kg of NPK ha^{-1} through fertigation at 7 days interval (A1N5) produced maximum number of branches (10.67), longest vine (362.0 cm), number of fruits $plant^{-1}$ (2.57), weight of fruit (5.27 kg), fruit yield (68.77 t ha^{-1}), maximum content of total soluble solid (10.94%), ascorbic acid (8.07 mg 100 g^{-1}) and improved the physic-chemical properties *viz.,* particle density (2.45 Mg m^{-3}), bulk density (1.31 Mg m^{-3}), percent pore space (48.33%), pH (6.58), EC (0.35 dSm^{-1}) and organic carbon content (0.52%).

Keywords: Organic Amendments, Fertigation, Soil properties, *Theri* land, Yield, and Watermelon

Introduction
Watermelon (*Citrullus lanatus* Thunb.) is grown extensively in India. It is a major tropical crop in Karnataka, Andhra Pradesh and Tamil Nadu. India is the second largest producer of watermelon fruit among the Asian countries accounting 2.48 million tonnes from 1.01 lakh hectare with the productivity of 24.58 t ha^{-1} (HSD, 2017) [11]. In Tamil Nadu, the production is 1.63 lakh tonnes and the average productivity of 23.52 t ha (DES, 2017) [7].

The *Theri* lands (red sand dunes) more in Tirunelveli and Thoothukudi districts of Tamil Nadu, located (77º 49' 44" to 78º 28' 22" E and from 8º 15'13" to 9º 11' 0" N) to an extent of 20,171 ha (Jawahar *et al.,* 1999) [12]. The soils have low nutrient status, low water holding capacity, low organic carbon content and are susceptible to high wind erosion (Manikandan and Subramanian, 2010) [18]. The mean annual rainfall of the study area is between 610 and 700 mm.

In *Theri* soils (red sand dune) organic amendments like tank silt, FYM, composted coir pith (CCP) etc. improve the physico-chemical properties of soil. Many organic amendments contain plant nutrients and act as organic fertilizers. Monitoring soil and plant nutrient status is an essential to ensure maximum crop productivity. It is well known that organic amendments and inorganic fertilizers are essential to increase the productivity of crops and fertility of soils. The fertigation technology is the possible way to improve the crop production and soil productivity for profitable farming in constrained *Theri* soil. Fertigation within the rhizosphere matches with the physiological needs of the crop *viz*. root development, vegetative growth, flower and fruit development. Scientific information on fertigation in *Theri* land (red sand dune), especially in watermelon, is very scanty. Hence, the present field experiment was conducted to determine influence of organic amendments combined with inorganic fertilizers through fertigation on growth, fruit yield of watermelon and soil fertility of *Theri* land.

Materials and Methods

Site description

The experiment was conducted during kharif – winter seasons (September to December) of 2018-2019 and 2019-2020 at Sattankulam taluk, Thoothukudi district, Tamil Nadu (Fig 1). The sand dune was isomegathermic and ustic regime from geogenic sand deposit under a semi arid climate. Soil at the experimental site was red fine sandy, with low organic carbon 0.12%, electrical conductivity 0.13 dS/m, neutral pH (6.66), low status of available N (93.7 kg ha^{-1}), P (8.2 kg ha^{-1}) and K (88.5 kg ha^{-1}), respectively. Seeds of watermelon F1 hybrid Suprit taken as test crop, sown with 60 cm plant-to-plant spacing, during the first week of November in both years.

Experimental design

The experiment was laid out in Factorial Randomized Block Design (FRBD) with six treatments and three replications (Fig 2). Factor as three organic amendments *viz*., tank silt @ 100 t ha^{-1}, composted coir pith @ 12.5 t ha^{-1} and farm yard manure @ 20 t ha^{-1} were applied as basal doses before sowing. The treatments were T_1- 75% recommended dose of fertilizers (RDF) (150:75:75 kg of NPK ha^{-1}) through soil application; T_2- 100% recommended dose of fertilizers (RDF) (200:100:100 kg of NPK ha^{-1}) through soil application; T_3- 75% recommended dose of fertilizers (RDF) (150:75:75 kg of NPK ha^{-1}) through fertigation at 7 days interval; T_4- 75% recommended dose of fertilizers (RDF) (150:75:75 kg of NPK ha^{-1}) through fertigation at 15 days interval; T_5- 100% recommended dose of fertilizers (RDF) (200:100:100 kg of NPK ha^{-1}) through fertigation at 7 days interval; T_6- 100% recommended dose of fertilizers (RDF) (200:100:100 kg of NPK ha^{-1}) through fertigation at 15 days interval.

Fertigation

Conventional fertilizers used in the experiment were urea, single super phosphate, di-ammonium phosphate and muriate of potash; whereas, 19 each of N, P_2O_5, K_2O and KNO_3 used as the source of water soluble fertilizer. Fertigation was done at 7 and 15 days intervals. Soil treatments received the entire P_2O_5 and K_2O at sowing and N in two splits as basal during sowing and at 30 DAS. Irrigation was given through drippers to all the treatments. Observations were taken 60 days after sowing. The agronomic and plant protection measures were adopted as per the guide lines of crop production guide for Tamil Nadu (HPG, TNAU, 2015) [6]. The crop was harvested at 90 to 100 days after attaining maturity of the fruit

Methods of analysis

The nutrient content were analysed and the uptake of nutrients were worked out through prescribed laboratory procedures. Soil organic carbon was estimated by following Walkley and Black (1934) [29], available N as described by Subbiah and Asija (1956) [25], available P (Olsen *et al*., 1954) [19] and available K by flame photometry with extracting 1 N NH_4OAc (Schollenberger and Simon, 1945) [23]. Observations regarding growth, yield, yield parameters and quality were recorded and statistically analyzed as per Gomez and Gomez (1984) [9]. Economics of water melon by means of cost benefit ratio influenced by amendments and fertigation and management practices were calculated by considering the prevailing market price of fruit and inputs used.

Results And Discussion

Growth, yield attributes and quality

Effect of amendments: The application of various organic amendments influenced the growth and yield attributing characters such as number of branches, number of fruits $plant^{-1}$ and fruit yield of watermelon (Figure 1) & (Fig 3).

Tank silt applied at the rate of 100 t ha^{-1} significantly registered more number of branches (8.72), more fruits (2.22) and higher fruit yield (55.49 t ha^{-1}), higher content of total soluble solid (9.80%) and ascorbic acid (7.41 mg 100 g^{-1}) followed by the treatment applied with composted coir pith by 12.5 t ha^{-1}, which registered next higher branches (8.22), number of fruits (2.10), fruit yield (50.43 t ha^{-1}), total soluble solid (9.79%) and ascorbic acid (7.29 mg 100 g^{-1}). All nutrients in tank silt is responsible for the enhanced growth and yield attributes in watermelon. Similar results in sunflower, groundnut, cotton, sugarcane, soybean, gingili, tomato, cotton, onion, brinjal, turnip, cucumber, chilli etc were noticed by Annadurai *et al.* (2005) [2].

Effect of nutrients

The number of branches, vine length, number of fruits and fruit weight were significantly influenced by amendments and fertigation (Figure 2). The application of recommended dose of NPK as 200:100:100 kg ha^{-1} through fertigation at 7 days interval (N5) (Table 1) significantly registered maximum number of branches (10.0), longest vine (347.89 cm), highest number of fruits $plant^{-1}$ (2.38), more weight of fruit (5.33 kg), higher fruit yield (63.32 t/ha), higher content of total soluble solid (10.75%) and ascorbic acid (8.05 mg 100 g^{-1}). The treatment applied with 75 percent NPK through fertigation at 7 days interval (N3) recorded the next higher values *viz*., number of fruit (9.0), long vine (339.22 cm), more number of fruits $plant^{-1}$ (2.28), weight of fruit (5.04 kg), higher fruit yield (58.38 t ha^{-1}), total soluble solid (10.63%) and ascorbic acid (7.99 mg 100 g^{-1}). The minimum number of branches (6.78), shortest vein length (268.44 cm), minimum number of fruits per plant (1.75), lowest fruit weight (4.29 kg), minimum fruit yield (38.36 t ha^{-1}), low content of total soluble solid (8.29%) and ascorbic acid (6.16 mg 100 g^{-1}) were found in treatment applied with 75 percent NPK ha^{-1} through soil application (T_1**).** The results are supported with the finding by Kadam *et al.*, (2009) [15]. Binitha, (2006) [4] also found similar result by tank silt at the rate of 20 t ha^{-1} fore higher number of pods, pod yield, haulm yield and shelling percentage in case of groundnut crop.

Combined effect of amendment and nutrients

The combined of amendments and nutrients played an important role in increasing the production of watermelon (Figure 3). The application of tank silt @ 100 t ha^{-1} along with 100 percent NPK as 200:100:100 kg ha^{-1} through fertigation at 7 days interval (A1N5) registered more number of branches (10.67), longer vine (362 cm), maximum number of fruits $plant^{-1}$ (2.57), heavy weight of fruit (5.27 kg), maximum fruit yield (68.77 t/ha), maximum content of total soluble solid (10.94%) and ascorbic acid (8.08 mg 100 g^{-1}) followed by 10.33 number of branches, 350 cm longer vine, 2.33 number of fruits $plant^{-1}$, 5.29 kg of fruit, higher fruit yield 62.76 t ha^{-1}, total soluble solid (10.82%) and ascorbic acid (8.06 mg 100 g^{-1}) were obtained from the application of composted coir pith @ 12.5 t ha^{-1} with 100 percent NPK through fertigation at 7 days interval (A2N5). The less number of branches (6.33), short vein length (259.33 cm), low number of fruits $plant^{-1}$ (1.67), low fruit weight (4.26 kg), minimum fruit yield (36.11 t ha^{-1}), low content of total soluble solid (8.17%) and ascorbic acid (6.08 mg 100 g^{-1}) were found in treatment applied with FYM @ 20 t ha^{-1} with 75 percent NPK ha^{-1} through soil application (A3N1). This result is supported by the earlier findings of Ramesh (2001) [20], Annadurai *et al.*,

(2005) [2] and Kadam *et al.*, (2009) [15]. They clearly suggested that combined application of amendments with nutrients maintain in increasing crop yield. The increase in the fruit yield might be due to the application of organic amendments in combination with inorganic fertilizers. There is a need to use organic and chemical fertilizers in combination with drip fertigation so as to increase crop productivity.

Physico-chemical properties

Effect of amendments

The treatment with tank silt @ 100 t ha^{-1} significantly registered the improved physical properties (Table 2) *viz.*, particle density, bulk density (2.49 and 1.35 Mg m^{-3}) and pore space (45.46%). The composted coir pith applied @ 12.5 t ha^{-1}, which registered the next better values *viz.*, particle density, bulk density (2.53 and 1.37 Mg m^{-3}) and pore space (44.33%). The improvement on pH (6.46), EC (0.28 dSm^{-1}) and organic carbon (0.38%) were also recorded for the treatment applied with tank silt @ 100 t ha^{-1}. The high clay and silt content in tank silt is responsible for the improvement of physic-chemical properties of the soil of *theri* land. Similar finding was obtained by Annadurai *et al.*, (2005) [2] for improvement of physic-chemical properties through the amendments of tank silt in *Theri* soil.

Effect of nutrients

The application of recommended dose of NPK as 200:100:100 kg ha^{-1} through fertigation at 7 days interval (N5) (Table 2) significantly registered improved physical properties *viz.*, particle density, bulk density (2.48 and 1.33 Mg m^{-3}) and pore space (46.60%) and chemical characteristics *viz.*, pH (6.49), EC (0.31 dSm^{-1}) and organic carbon (0.39%) followed by the application of 75 percent NPK through fertigation at 7 days interval (N3) with the particle density, bulk density (2.51 and 1.35 Mg m^{-3}) and pore space (45.68%). However, among the two levels of NPK without fertigation, the minimum improvement of physic-chemical properties *viz.*, particle density and bulk density (2.55 and 1.38 Mg m^{-3}), percent pore space (42.13%), pH (6.35) EC (0.24 dSm^{-1}) and organic carbon (0.24) were observed in treatment applied with 75 percent NPK ha^{-1} through soil application (T_1**).** The present finding was supported by Binitha, (2006) [4] and Kadam *et al.*, (2009) [15]

Combined effect of amendment and nutrients

The interaction effect was significant for all physic-chemical properties of the *theri* land. The least values of particle density and bulk density (2.45 and 1.31 Mg m^{-3}), highest value of percent pore space (48.33%), increased pH (6.58), EC (0.35 dSm^{-1}) and organic carbon content (0.52%) were registered by the application of tank silt @ 100 t ha^{-1} along with 100 percent NPK as 200:100:100 kg ha^{-1} through fertigation at 7 days interval (A1N5). The next better performance was observed for particle density and bulk density (2.50 and 1.34 Mg m^{-3}), percent pore space (46.10%), pH (6.48), EC (0.29 dSm^{-1}) and organic carbon content (0.35%) by the application of composted coir pith @ 12.5 t ha^{-1} with 100 percent NPK through fertigation at 7 days interval (A2N5). Among the two levels of NPK without fertigation the minimum improvement of physic-chemical properties *viz.*, particle density and bulk density (2.55 and 1.38 Mg m^{-3}), percent pore space (41.20%), pH (6.32) EC (0.26 dSm^{-1}) and organic carbon (0.21) were found in treatment applied with FYM @ 20 t ha^{-1} with 75 percent NPK ha^{-1} through soil application (A3N1). The improvement of soil physic-chemical characteristics might be due to the application of organic amendments in combination with inorganic fertilizers. This result is supported by the earlier findings of Annadurai *et al.*, (2005) [2], Kadam *et al.*, 2009) [15], Manikandan and Subramanian, (2010) [18].

Nutrient uptake

Effect of amendments

The uptake of N, P and K in watermelon was also influenced by the organic amendments (Table 3). The highest values of N and K uptake (32.90, and 24.09 kg ha^{-1}, respectively) by watermelon were recorded with the application of tank silt @ 100 t ha^{-1}(A1). Application of composted coir pith @ 12.5 t ha^{-1} (A2) which recorded the values of 31.69 and 21.88 kg ha^{-1}, The highest phosphorus uptake (3.17 kg ha^{-1}) was recorded in treatment applied with composted coir pith @ 12.5 t ha^{-1}(A2) followed by the treatment with tank silt @100 t ha^{-1} (A1) by recording the value of 2.96 kg ha^{-1}. The treatment applied with FYM @ 20 t ha^{-1}(A3) noticed for the minimum uptake of N, P and K (26.32, 2.78 and 19.49 kg ha^{-1}, respectively). The content of all macro and micronutrients in organic amendments enhanced the steadily supply of nutrient at all critical stages of the crop resulted more nutrient uptake by the crop. The result confirms the findings of Ramesh (2001) [20] and Annadurai *et al*. (2005) [2].

Effect of nutrients

The highest values of N, P and K uptake (39.79, 4.04, and 30.49 kg ha^{-1}, respectively) by watermelon were recorded with the application of 100 percent NPK as 200:100:100 kg ha^{-1} through fertigation at 7 days interval (N5). The higher values of N, P and K uptake (36.68, 3.71 and 28.30 kg ha^{-1}, respectively) for the treatment of 75 percent NPK through fertigation at 7 days interval (N3). The lowest uptake of N, P and K (20.13, 1.86 and 11.97 kg ha^{-1}, respectively) were observed in the treatment with soil application of 75% recommended dose of NPK (N1). This could be ascribed to the increase in the available N, P and K contents in soil resulting from the increasing availability of nutrients which ultimately increased nutrient content in the plant tissue and also greater biomass production at higher rate of fertilizer application. The result confirm the findings of Shyamaa *et al.*, 2009 [24] and Sajitha *et al.*, (2016) [22].

Combined effect of amendments and nutrients

The combination of amendments and fertilizers played major role in increasing the nutrient uptake of watermelon. The treatment applied with tank silt @ 100 t ha^{-1} with 100 percent NPK as 200:100:100 kg ha^{-1} through fertigation at 7 days interval (A1N5) registered the maximum uptake of N and K (41.51 and 31.94 kg ha^{-1}). The maximum P uptake (4.27 kg ha^{-1}) was registered for the treatment applied with composted coir pith @ 12.5 t ha^{-1} with 100 percent NPK through fertigation at 7 days interval (A2N5). The minimum values of N, P and K uptake (18.35, 1.92 and 9.65 kg ha^{-1}) were recorded in the treatment applied with FYM @ 20 t ha^{-1} with 75 percent NPK ha^{-1} through soil application (A3N1). The increased uptake of N, P and K in watermelon may be due to more availability of these nutrients from the added tank silt, fertilizer sources and the solubility action of organic acids produced during the decomposition of organic materials. Similar results were also reported by Ganeshappa (2000) [8] and Tanwar *el al.*, (2003) [6].

Fertility status

Effect of amendments

The highest organic carbon (0.38%), available N, P and K (196.07, 13.41 and 193.17 kg ha^{-1}, respectively) (Table 3) were obtained by the application of tank silt @ 100 t ha^{-1} (A1). The

treatment applied with composted coir pith @ 12.5 t ha^{-1} (A2) which recorded the 0.27% of organic carbon with available N, P and K (188.79,12.98 and 174.30 kg ha^{-1}, respectively). The content of organic carbon and all nutrients in tank silt and composted coir pith helped in sustaining the organic carbon and available N, P and K in the soil. Battilani and Solimando (2006) [3] and Gonsalves, *et al.* (2011) [10] delivered similar findings.

Effect of Nutrients

The application of 100 percent NPK through fertigation at 7 days interval (N5) registered the maximum organic carbon (0.39%), available N, P and K (242.23, 16.48 and 203.55 kg ha^{-1}, respectively). The next superior values of organic carbon (0.34%), available N, P and K (216.62, 14.27 and 186.53 kg ha^{-1}, respectively) were recorded for the treatment which received 75 percent NPK as 150:75:75 kg ha^{-1} through fertigation at 7 days interval (N3). The lowest content of organic carbon (0.24%) and available N, P and K (139.71, 9.71 and 149.50 kg ha^{-1}, respectively) were noticed in the treatment received 75 percent NPK as 150:75:75 kg ha^{-1} through soil application (N1) (Table 2). The decline in the available N status of the soil might be attributed to the utilization of N, P and K for growth of watermelon. These results are in agreement with the findings of Umamaheswarappa *et al.*, (2005) [27] and Castellanos *et al.*, (2012) [5].

The highest organic carbon (0.52%), available N, P and K (253.47, 16.40 and 218.40 kg ha^{-1}, respectively) were obtained from the treatment applied with tank silt @ 100 t ha^{-1} with 100 percent NPK as 200:100:100 kg ha^{-1} through fertigation at 7 days interval (A1N5). Application of composted coir pith @ 12.5 t ha^{-1} with 100 percent NPK through fertigation at 7 days interval (A2N5) recorded the next highest content of organic carbon (0.35%) and available N, P and K (242.73, 17.37 and 202.63 kg ha^{-1}, respectively). The higher content of organic carbon in soil might be due highly fertile tank silt and composted coir pith combined with inorganic nutrients is responsible for needed nutrient transformation besides providing favourable physico-chemical properties which help in the mineralization of soil nutrients leading to higher availability of N, P and K in soil. These results are in agreement with the findings of Kadam and Karthikeyan (2006) [14] and Kacha *et al.*, (2017) [13]. The lowest organic carbon content (0.21%) and available N, P and K (132.27, 9.23 and 140.6 kg ha^{-1}, respectively)were observed for the treatment applied with FYM @ 20 t ha^{-1} with 75 percent NPK ha^{-1} through soil application (A3N1). These results are in agreement with the findings of Krishnappa *et al.* (1998) [17] and Vasanth Kumar *et al.*, (2012) [28].

Economics

The economics and benefit:cost ratio in watermelon F1 hybrid Suprit in relation to various organic amendments with inorganic fertilizers with and without fertigation treatments tested are presented in Table 4**.**

Effect of amendments

The maximum net return (₹1,98,795) and benefit:cost ratio (1.88) was obtained from the treatment of tank silt @ 100 t ha^{-1}(A1). The application of FYM @ 20 t ha^{-1} (A3) which recorded the higher net return (₹1,55,355) and benefit:cost ratio (2.33). This might be due the cheap cost of manures reduced the cost of cultivation and increased the net return.

Effect of nutrients

The highest net return (₹2,48,090) with the benefit:cost ratio (2.61) were obtained by the application of 100 percent NPK through fertigation at 7 days interval (N5). The next highest net return (₹2,25,860) with the benefit:cost ratio (2.52) were recorded for the treatment which received 75 percent NPK as 150:75:75 kg ha^{-1} through fertigation at 7 days interval (N3). The lowest net return (₹68,493) with the benefit:cost ratio (1.52) were recorded in the treatment received 75 percent NPK as 150:75:75 kg ha^{-1} through soil application (N1).

Combined effect of amendments and nutrients

The treatment with tank silt @ 100 t ha^{-1} with 100 percent NPK as 200:100:100 kg ha^{-1} through fertigation at 7 days interval (A1N5) fetched significantly the highest net returns (₹2,90,570 and benefit: cost ratio (2.45) over the rest of the treatments. The better treatment was application of tank silt @ 100 t/ha with 75 percent NPK as 150:75:75 kg ha^{-1} through fertigation at 15 days interval (A1N3), which fetched a net return of ₹ 2,60, 560 and benefit: cost ratio of 2.31. The application of CCP@ 12.5 t ha^{-1} with 100 percent NPK as 200:100:100 kg ha^{-1} through fertigation at 7days interval (A2N5) recorded the net return of ₹ 2,30, 790 and benefit: cost ratio of 2.66 which was higher than the application of FYM @ 20 t ha^{-1} with 100 percent NPK as 200:100:100 kg ha^{-1} through fertigation at 7 days interval (A3N5) by fetching the net return of ₹ 2,22, 910 and benefit: cost ratio of 2.73. This might be due to increased higher productivity and lower cost of cultivation. The variation in the cost of cultivation under different treatments were recorded due to variable costs of fertilizers. Fruit yield was the major factor, which caused differences in net return. These results are in close conformity with the findings of Kumar *et al.*, (2007) [16] and Sajitha (2013) [21].

Table 1: Effect of organic amendment with fertigation on growth and yield of hybrid watermelon (Pooled mean of two years)

Treatments	No. of branches plant^{-1}	Vine length (cm)	No. of fruits plant^{-1}	Average fruit wt. (kg)	Fruit yield (t ha^{-1})	TSS (%)	Ascorbic acid (mg100 g^{-1})
	Main factor (Amendments)						
(A1) Tank silt @ 100 t ha^{-1}	8.72	308.16	2.22	4.76	55.49	9.80	7.41
(A2) Composted coir pith @ 12.5 t ha^{-1}	8.22	312.11	2.10	4.71	50.43	9.79	7.29
(A3) Farm yard manure (FYM) @ 20 t ha^{-1}	7.55	300.89	2.02	4.87	49.40	9.45	7.20
Mean	8.17	307.05	2.12	4.78	51.77	9.68	7.30
SEd	0.215	11.36	0.040	0.094	0.304	0.005	0.004
CD (P=0.05)	0.597	NS	0.112	NS	0.846	0.009	0.011
Main factor (Nutrients)							
N_1- 75% RDF (Soil application)	6.78	268.44	1.75	4.29	38.36	8.29	6.16
N_2 -100% RDF (Soil application)	7.22	297.11	2.00	4.54	45.54	9.28	6.64
N_3 -75% RDE at 7 days interval (Fertigation)	9.00	339.22	2.28	5.04	58.38	10.63	7.99
N_4 -75% RDF at 15 days interval (Fertigation)	7.67	279.33	2.10	4.71	50.80	9.41	7.33

N_5-100% RDF at 7 days interval (Fertigation)	10.00	347.89	2.38	5.33	63.32	10.75	8.05
N_6 -100% RDF at 15 days interval (Fertigation)	8.33	310.33	2.17	4.78	54.22	9.71	7.61
Mean	8.17	307.05	2.12	4.78	51.77	9.68	7.30
SEd	0.28	20.18	0.081	0.080	0.245	0.009	0.007
CD (P=0.05)	0.57	41.21	0.165	0.164	0.501	0.018	0.014
Interaction							
A1N1	7.33	275.67	1.83	4.41	41.12	8.43	6.28
A1N2	8.00	305.00	2.03	4.54	47.85	9.24	6.84
A1N3	9.33	351.00	2.40	4.86	61.73	10.8	8.05
A1N4	8.33	228.67	2.20	4.69	54.25	9.49	7.44
A1N5	10.67	362.00	2.57	5.27	68.77	10.94	8.08
A1N6	8.67	326.67	2.30	4.80	58.19	9.82	7.74
A2N1	6.67	270.33	1.77	4.22	37.85	8.29	6.13
A2N2	7.33	298.33	2.03	4.50	44.40	9.38	6.62
A2N3	9.00	338.33	2.27	5.07	56.48	10.60	7.98
A2N4	7.67	308.00	2.10	4.49	49.33	9.68	7.36
A2N5	10.33	350.00	2.33	5.29	62.76	10.82	8.06
A2N6	8.33	307.67	2.13	4.74	52.78	10.02	7.58
A3N1	6.33	259.33	1.67	4.26	36.11	8.17	6.08
A3N2	6.33	288.00	1.93	4.58	44.38	9.22	6.45
A3N3	8.67	328.33	2.20	5.20	55.93	10.49	7.94
A3N4	7.00	301.33	2.00	4.94	48.83	9.06	7.20
A3N5	9.00	331.67	2.27	5.42	59.47	10.47	8.03
A3N6	8.00	296.67	2.07	4.81	51.69	9.28	7.52
Mean	8.17	307.05	2.12	4.78	51.77	9.68	7.30
A@N							
SEd	0.494	33.86	0.134	0.158	0.493	0.015	0.012
CD (P=0.05)	NS	NS	NS	NS	1.145	0.032	0.025
N@A							
SEd	0.487	34.95	0.140	0.138	0.425	0.016	0.012
CD (P=0.05)	NS	NS	NS	NS	0.868	0.032	0.025

Table 2: Effect of organic amendment with fertigation on physico-chemical properties of soil (Pooled mean of two years)

Treatments	Physical properties			Chemical properties		
	Particle density (Mg m^{-3})	Bulk density (Mg m^{-3})	Pore space (%)	pH	EC (dSm^{-1})	Organic carbon (%)
	Main factor (Amendments)					
(A1) Tank silt @ 100 t ha^{-1}	2.49	1.35	45.46	6.46	0.32	0.38
(A2) Composted coir pith @ 12.5 t ha^{-1}	2.54	1.37	44.33	6.37	0.26	0.27
(A3) Farm yard manure (FYM) @ 20 t ha^{-1}	2.53	1.38	43.67	6.38	0.28	0.25
Mean	2.52	1.37	44.49	6.41	0.29	0.30
SEd	0.0014	0.0032	0.144	0.001	0.004	0.001
CD (P=0.05)	0.0040	0.0091	0.401	0.002	0.012	0.004
Main factor (Nutrients)						
N_1- 75% RDF (Soil application)	2.55	1.38	42.13	6.35	0.24	0.24
N_2 -100% RDF (Soil application)	2.53	1.37	43.30	6.38	0.28	0.26
N_3 -75% RDE at 7 days interval (Fertigation)	2.51	1.35	45.68	6.48	0.31	0.34
N_4 -75% RDF at 15 days interval (Fertigation)	2.51	1.37	44.81	6.37	0.29	0.29
N_5-100% RDF at 7 days interval (Fertigation)	2.48	1.33	46.60	6.49	0.31	0.39
N_6 -100% RDF at 15 days interval (Fertigation)	2.54	1.37	44.41	6.35	0.29	0.27
Mean	2.52	1.37	44.49	6.41	0.29	0.30
SEd	0.0015	0.0053	0.22	0.002	0.006	0.002
CD (P=0.05)	0.0031	0.011	0.45	0.003	0.013	0.004
Interaction						
A1N1	2.56	1.39	42.22	6.39	0.25	0.28
A1N2	2.51	1.37	44.31	6.48	0.31	0.33
A1N3	2.46	1.33	47.07	6.57	0.33	0.42
A1N4	2.48	1.36	44.98	6.48	0.34	0.38
A1N5	2.45	1.31	48.33	6.58	0.35	0.52
A1N6	2.55	1.38	45.93	6.38	0.31	0.35
A2N1	2.57	1.36	43.05	6.37	0.28	0.25
A2N2	2.57	1.37	43.23	6.38	0.23	0.26
A2N3	2.57	1.35	46.00	6.43	0.28	0.32
A2N4	2.51	1.39	44.43	6.25	0.25	0.24
A2N5	2.50	1.34	46.10	6.48	0.29	0.35
A2N6	2.54	1.36	43.27	6.33	0.28	0.23
A3N1	2.55	1.38	41.20	6.32	0.26	0.21

A3N2	2.53	1.38	42.37	6.32	0.31	0.23
A3N3	2.52	1.37	43.97	6.46	0.31	0.28
A3N4	2.55	1.39	45.03	6.40	0.28	0.26
A3N5	2.50	1.35	45.37	6.42	0.29	0.30
A3N6	2.55	1.38	44.07	6.35	0.26	0.24
Mean	2.52	1.37	44.49	6.41	0.29	0.30
A@N						
SEd	0.0028	0.009	0.38	0.003	0.011	0.003
CD (P=0.05)	0.0062	0.019	0.81	0.006	0.024	0.008
N@A						
SEd	0.0026	0.009	0.38	0.003	0.011	0.003
CD (P=0.05)	0.0054	0.019	0.78	0.006	0.023	0.007

Table 3: Effect of organic amendment with inorganic fertilizers on nutrient uptake of hybrid watermelon and soil fertility (Polled mean of two years)

Treatments	Nutrient uptake (kg/ha)			Available nutrients (kg/ha)		
	N	P	K	N	P	K
	Main factor (Amendments)					
(A1) Tank silt @ 100 t ha^{-1}	32.90	2.96	24.09	196.07	13.41	193.17
(A2) Composted coir pith @ 12.5 t ha^{-1}	31.69	3.17	21.88	188.79	12.98	174.30
(A3) Farm yard manure (FYM) @ 20 t ha^{-1}	26.32	2.78	19.49	178.59	12.52	165.35
Mean	30.47	2.97	21.82	187.82	12.97	177.61
SEd	0.150	0.128	0.072	0.397	0.047	0.104
CD (P=0.05)	0.417	NS	0.201	1.103	0.131	0.289
Main factor (Nutrients)						
N_1- 75% RDF (Soil application)	20.13	1.86	11.97	139.71	9.71	149.50
N_2 -100% RDF (Soil application)	25.61	2.58	17.63	158.04	12.03	169.80
N_3 -75% RDE at 7 days interval (Fertigation)	36.68	3.71	28.30	216.62	14.27	186.53
N_4 -75% RDF at 15 days interval (Fertigation)	28.54	2.67	20.59	182.51	12.47	175.79
N_5-100% RDF at 7 days interval (Fertigation)	39.79	4.04	30.49	242.23	16.48	203.55
N_6 -100% RDF at 15 days interval (Fertigation)	32.08	2.97	21.94	187.79	12.85	180.47
Mean	30.47	2.97	21.82	187.82	12.97	177.61
SEd	0.204	0.078	0.099	0.668	0.084	0.110
CD (P=0.05)	0.416	0.160	0.201	1.364	0.173	0.227
Interaction						
A1N1	22.58	1.52	15.34	146.43	10.53	165.40
A1N2	27.34	2.77	20.61	175.20	12.63	182.47
A1N3	39.30	3.79	29.88	209.23	14.80	202.53
A1N4	31.47	2.88	23.55	198.70	12.53	193.77
A1N5	41.51	3.93	31.94	253.47	16.40	218.40
A1N6	35.21	2.91	23.22	193.37	13.57	196.47
A2N1	19.45	2.14	10.94	140.43	9.37	142.50
A2N2	26.22	2.71	17.63	155.47	11.90	168.43
A2N3	38.32	3.88	29.30	222.33	14.30	183.63
A2N4	30.22	2.84	19.99	183.47	12.50	172.03
A2N5	40.37	4.27	30.00	242.73	17.37	202.63
A2N6	35.58	3.17	23.43	188.33	12.43	176.37
A3N1	18.35	1.92	9.65	132.27	9.23	140.60
A3N2	23.29	2.26	14.67	143.47	11.57	158.50
A3N3	32.43	3.48	25.71	218.30	13.70	173.43
A3N4	23.92	2.29	18.24	165.37	12.37	161.57
A3N5	37.47	3.91	29.52	230.50	15.70	189.63
A3N6	25.46	2.85	19.18	181.67	12.57	168.37
Mean	30.47	2.97	21.82	187.82	12.97	177.61
A@N						
SEd	0.356	0.179	0.172	1.128	0.142	0.204
CD (P=0.05)	0.773	0.433	0.373	2.407	0.301	0.456
N@A						
SEd	0.353	0.135	0.171	1.157	0.146	0.192
CD (P=0.05)	0.721	0.277	0.349	2.363	0.299	0.392

Table 4: Effect of organic amendment with inorganic fertilizers on economics of hybrid watermelon (mean of two years)

Treatments	Cost of cultivation (₹/ha)	Gross return (₹/ha)	Net return (₹/ha)	Benefit: cost ratio
	Main factor (Amendments)			
(A1) Tank silt @ 100 t ha^{-1}	1,01,729	3,00,417	1,98,795	1.88
(A2) Composted coir pith @ 12.5 t ha^{-1}	1,21,618	2,74,307	1,52,688	2.20
(A3) Farm yard manure (FYM) @ 20 t ha^{-1}	1,11,618	2,66,973	1,55,355	2.33
Mean	1,11,655	2,80,565	1,68,946	2.14
SEd	90.76	10.73	8.22	0.004
CD (P=0.05)	250.90	30.28	22.78	0.010
Main factor (Nutrients)				
N_1- 75% RDF (Soil application)	82,820	1,51,300	68,493	1.52
N_2 -100% RDF (Soil application)	93,972	1,81,053	87,303	1.62
N_3 -75% RDE at 7 days interval (Fertigation)	1,22,820	3,48,680	2,25,860	2.52
N_4 -75% RDF at 15 days interval (Fertigation)	1,17,820	3,02,760	1,84,940	2.26
N_5-100% RDF at 7 days interval (Fertigation)	1,28,750	3,76,860	2,48,090	2.61
N_6 -100% RDF at 15 days interval (Fertigation)	1,23,750	3,22,740	1,98,990	2.29
Mean	1,11,655	2,80,565	1,68,946	2.14
SEd	128.30	11.41	11.55	0.003
CD (P=0.05)	262.04	23.32	23.58	0.006
Interaction				
A1N1	72,820	1,62,640	89,820	1.23
A1N2	83,750	1,88,560	1,04,810	1.25
A1N3	1,12,820	3,73,380	2,60,560	2.31
A1N4	1,07,820	3,22,440	2,14,620	1.99
A1N5	1,18,750	4,09,320	2,90,570	2.45
A1N6	1,13,750	3,46,080	2,32,330	2.04
A2N1	92,820	1,48,200	55,380	1.60
A2N2	1,03,750	1,79,200	75,450	1.73
A2N3	1,32,820	3,41,580	2,08,760	2.57
A2N4	1,27,820	2,95,140	1,67,320	2.31
A2N5	1,38,750	3,69,540	2,30,790	2.66
A2N6	1,33,750	3,12,180	1,78,430	2.33
A3N1	82,820	1,43,040	60,220	1.73
A3N2	93,750	1,75,400	81,650	1.87
A3N3	1,22,820	3,31,080	2,08,260	2.69
A3N4	1,17,820	2,90,700	1,72,880	2.47
A3N5	1,28,750	3,51,660	2,22,910	2.73
A3N6	1,23,750	3,09,960	1,86,210	2.50
Mean	1,11,655	2,80,565	2,80,565	2.14
A@N				
SEd	222.22	21.08	20.00	0.006
CD (P=0.05)	NS	47.18	43.29	0.014
N@A				
SEd	222.00	19.78	20.00	0.005
CD (P=0.05)	NS	40.39	40.84	0.010

Fig 1: General view of *Theri* land (Red sand dune)

Fig 2: View of experimental site

Fig 3: Effect of treatment of fruit yield

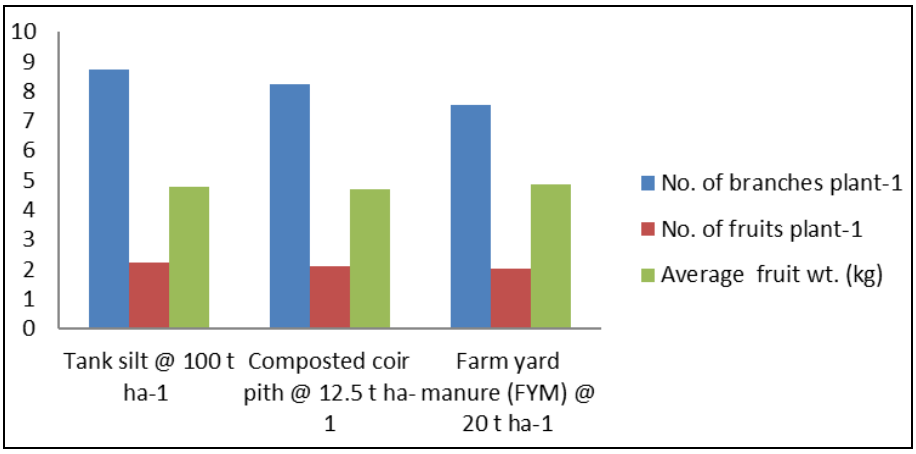

Fig 4: Influence of tank silt and organic manure application on biometric characteristics of water melon

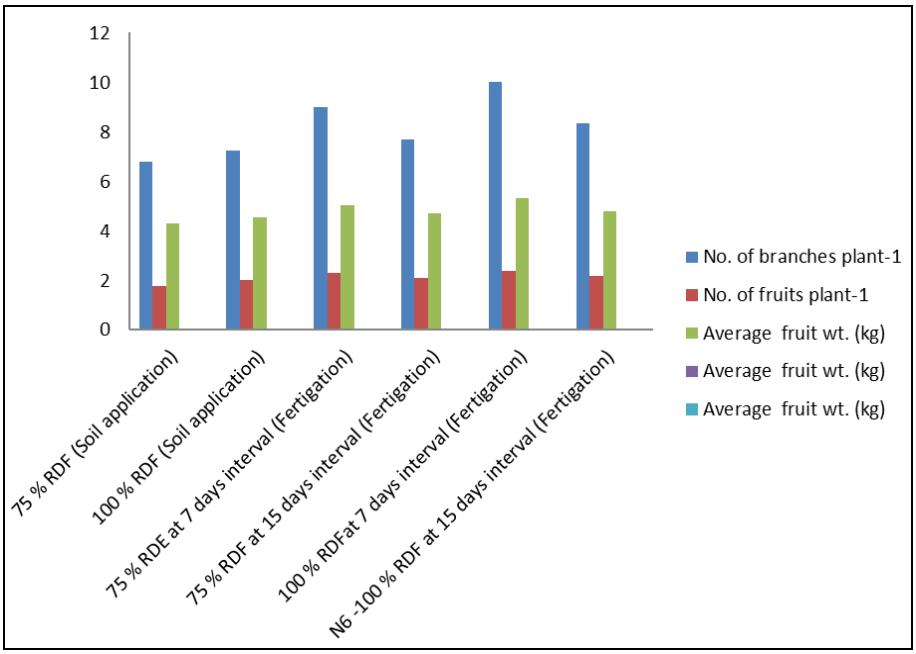

Fig 5: Influence nutrient application on biometric characteristics of water melon

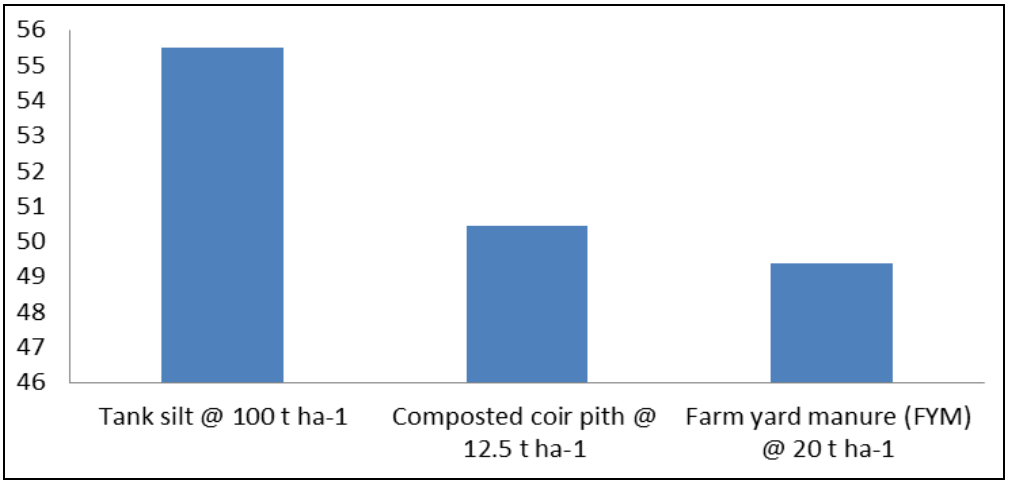

Fig 6: Influence of tank silt and organic manure application on fruit yield of water melon (t/ha)

Conclusion

From the above data It can be concluded that application of tank silt @ 100 t ha^{-1} with 100 percent NPK as 200:100:100 kg ha^{-1} through fertigation at 7 days interval (A1N5) could be recommended for increasing the fruit yield of hybrid watermelon, better net return and sustaining soil fertility in *Theri* land (Red sand dune) of Thoothukudi district of Tamil Nadu.

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