Influence of organic and inorganic sources of nutrition on Growth, Yield and Quality of strawberry (*Fragaria x ananassa* Duch) cv. Sweet Charlie

ABSTRACT A field experiment was carried out during 2021-2022 to see the effect of Organic and Inorganic Sources on growth, yield and quality of strawberry cv. Sweet Charlie with 7+1 treatments with different combinations of organic and inorganic sources of nutrients (Vermicompost, FYM, and NPK) replicated thrice in Randomized Block Design. Observations were recorded for vegetative growth, fruit yield, and quality. In different combinations of (organic manure and inorganic manure) the treatment T_7 (30%Vermicompost + 30% FYM + 40% NPK) recorded highest plant height, plant spread, number of leaves and flowers as compared to T_0 (control + NPK). Plant treatment T_7 (30%Vermicompost + 30% FYM + 40% NPK) registered earliest flowering and also highest number of flowers per plant. The maximum fruit weight, number of fruits per plant and yield were recorded with plants treated with T_7 (30%Vermicompost + 30% FYM + 40% NPK) followed by T_8 (20%Vermicompost + 20% FYM + 60% NPK) at 90 DAP. The maximum Benefit: Cost ratio (1: 3.42) was recorded in T_7 (30%FYM + 30% Vermicompost + 40% NPK) than T_8 (20%FYM + 20% Vermicompost + 60% NPK) Due to its high productivity, The highest yield and best quality fruit were recorded in the combination of T_7 (30%FYM + 30% Vermicompost + 40% NPK).

Key words: Strawberry, Organic manure, Inorganic manure, Growth ,Yield, Quality

INTRODUCTION

Strawberry (*Fragaria x ananassa*) belongs to the Rosaceae family and is one of the mostpopular hybrid species. For its fruit, it is grown all over the world. The fruit is renowned for its distinctive flavor, melting flesh, vivid red color, juicy texture, and sweetness. In terms of composition, ripe strawberries typically contain 89.5 percent water, 0.4 percent ash, 3.7 percent to 8.5 percent sugar, and significant quantities of pectin (0.5 percent to 1.36 percent), but no starches. The vitamin and mineral content of fresh, ripe strawberries is high (Singh *et al.* 2007). For best growth and development, strawberries require an ideal day temperature of 22 to 23C and an ideal night temperature of 7 to 13 C. The Plant has fibrous root system and most of its roots are confined to the top 15-20 cm layer of the Soil, and it grows best in the light porous soil that is rich in humus (Singh and Sharma, 1970; Sharma and Singh,1999; Sharma, 2002). Characteristics of substrates include holding water and nutrient, providing good aeration to root system, light weight, free of pathogenic organisms and substances that are toxic to plants (Johnson *et al.* 2010). Berry production is significantly reduced by frost damage and winter damage. In sandy loam soils with a pH range of 5.5 to 6.5, plants thrive. Albinism is a physiological condition that is brought on by extremes in nutrition and environmental conditions, which impair berry yield and quality.

The fully mature ripe fruit has a sweet-sour taste and a pleasant aroma. Fruits are mostly eaten fresh, and are consumed not for the food value but for the flavor. It is a fairly good source of vitamin A (60 IU/100gof edible portion) and vitamin C (30-120mg/100g of edible portion). Ripe strawberries attain attractive red color on maturity. The red color of the fruit is mainly due to the presence of an anthocyanin, pelargonidin3-monoglucoside and traces of cyanidin (Singh and Sharma, 1970 and Mitra, 1991). The use of different organic and inorganic substrates allows the plants better nutrient uptake, sufficient growth and development to optimize water andoxygen holding (Albaho *et al.* 2009). Since ancient times, farmyard manure has been used as a nutritional supplement and to enhance the physical qualities of the soils. Many live micro- and macro-organisms, including bacteria, fungus, insects, and more can be found in manure from farms. These organisms participate in a number of oxidation-reduction processes that liberate a number of beneficial nutrients and stimulate the production of the hormones and enzymes required by the plants for maximum growth and development. Vermicompost is a rich mixture of major and minor plant nutrients having finely-divided mature peat-likematerials with a high porosity, aeration, drainage, and water-holding capacity and microbial activity which are stabilized by interactions between earthworms and microorganisms in a non-thermophilic process (Edwards and Burrows, 1988).Vermicompost contains most nutrients in plant-available forms such as nitrates, phosphates, and exchangeable calcium andsoluble potassium (Orozco *et al.* 1996; Edwards, 1998). Vermicompost have large particulate surface areas that provide many microsites for microbial activity and for the strong retention of nutrients (Shi-wei and Fu-zhen, 1991). It increases total microbial population of Nitrogen Fixing Bacteria, actinomycetes and symbiotic associations of mycorrhizae in the root system. Vermicompost is widely used in horticultural crop production and has the character of being one of the most valuable organic manures. Organic manures like vermicompost, FYM, have been utilized in agriculture along with NPK. as a significant source of nutrient. These manures help not only in bridging the existing wide gap between the nutrient removal and supply but also in insuring balanced nutrient proportion, byenhancing response efficiency, and maximizing crop productivity of desired quality

MATERIALS AND METHODS

The area of Allahabad district comes under subtropical belt in the South east of Uttar Pradesh, which experience extremely hot summer and fairly cold winter. The major part of rain is received from mid-July to September. The winter season starts from November and continue up to the first week of March with mean temperature ranging from 15 – 25 ºC. The hot season prevails from April to June, May normally being the hottest month of the year. The temperature during summer is intense and recorded a little below 45 ºC; relative humidity during summer varies from 20 to 95 per cent. The Meteorological observations were recorded at the meteorological observatory in the research farm of Sam Higginbottom Institute of Agriculture, Technology & Sciences, Allahabad, Uttar Pradesh. during 2021 2022. Treatments includes T_0 control + NPK T_1(50%) FYM + (50%) NPK, T_2(50%) Vermicompost + (50%) NPK, T_3(75%) FYM + (25%) NPK, T_4(75%) Vermicompost + (25%) NPK, T_5(25%) FYM + (75%) NPK, T_6(25%) Vermicompost +(75%) NPK, T_7(30%) Vermicompost + (30%) FYM + (40%) NPK T_8(20%) FYM + (20%) Vermicompost + (60%) NPK. The experiment was laid down in Randomized Block Design with three replications. The observations were recorded on the four randomly selected plants form each treatment. Vegetative characteristics [Plant height (cm), Plant spread (cm), Number of leaves per plant] were

recorded, floral characteristics as [(number of flowers per plant, days to first blooming], Yield attributes [number of fruits per plant, Fruit production per plant (g), fruit weight (g), fruit diameter (cm), fruit length (cm)] Plant-1's Quality characteristics were [Total Soluble Solids (°Brix), Acidity (%), Ascorbic Acid (Vit C) (mg/100g), and Economics (Benefit: Cost ratio). The data gathered throughout the research was statistically analyzed.

RESULTS AND DISCUSSION

VEGETATIVE CHARACTERS

From the above (Table 1) & (Graph 1) the visible effects of the plants treated with (30%) Vermicompost + (30%) FYM + (40%) NPK showed the maximum increase plant height, plant spread and number of leaves per plant. The maximum plant height (19.24cm), plant spread (18.56 cm), number of leaves (20.32) which were significantly and statistically at par to (20%) FYM + (20%) Vermicompost + (60%) NPK treatment. and significantly results with other treatment combinations. Nutrition is one of the most important parts of crop production and accounts for around one third of the total cost of production among the different factors that affect strawberry development. Chemical fertilizers are frequently employed to boost output, but they can also over time deplete the soil's fertility (Sinha *et al.* 2009). Chemical fertilizers currently play a significant role in meeting the need for nutrients, but their frequent, excessive, and imbalanced usage can have negative effects on human health and the environment, deplete the soil's physico-chemical qualities, and eventually result in subpar yields. Organic additives influence metabolic plant processes such as cell division and enzyme activity, and have a positive effect on strawberry vegetative metrics (Ogendo *et al.* 2008) By adding important nutrients to the soil, organic manures like FYM and Vermicompost boost with NPK increases the availability of nutrients and the likelihood that plants will eventually absorb them.

Graph 1: Effect of organic and inorganic source of nutrition on vegetative growth charactersof strawberry

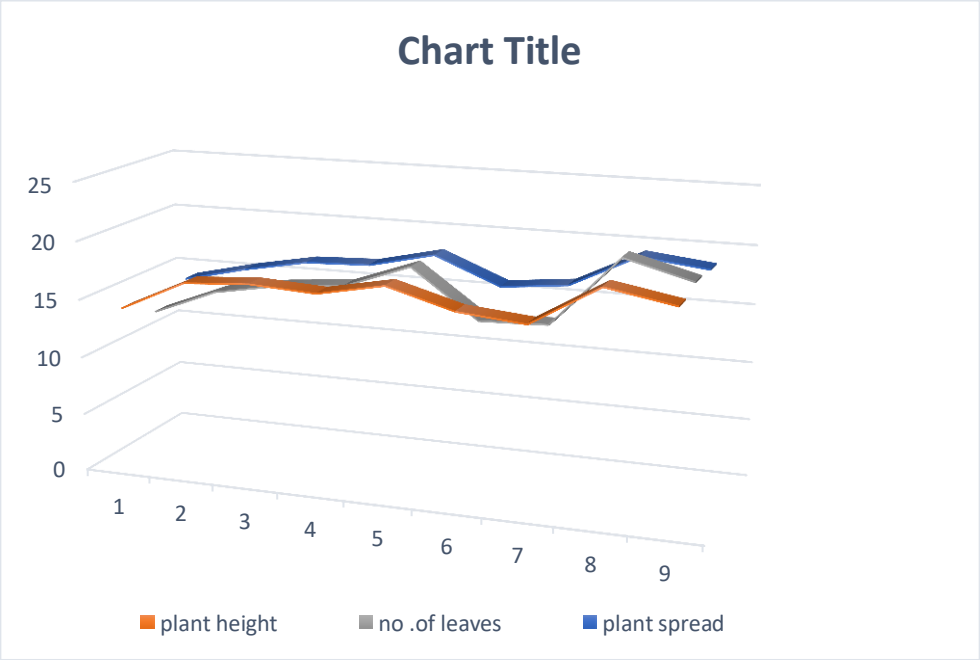


Table1: Effect of organic and inorganic sources of nutrition on vegetative growth characters of strawberry

Treatment	Treatment combination	Plant height (cm) (90 days)	Plant spread (cm) (90 days)	Number of leaves(90 days)
T0	Water Control +NPK	14.10	14.11	12.43
T1	50%FYM + 50% NPK	16.75	15.43	16.68
T2	50% Vermicompost + 50%NPK	17.12	16.50	15.67
T3	75% FYM+ 25% NPK	16.80	16.72	16.15
T4	75%Vermicompost + 25%NPK	17.92	18.03	18.23
T5	25%FYM + 75% NPK	16.31	15.73	14.15
T6	25%Vermicopost + 75%NPK	15.78	16.33	15.01
T7	30%Vermicompost + 30%FYM + 40% NPK	19.24	19.20	20.32
T8	20%FYM + 20% Vermicompost + 60% NPK	18.21	18.56	18.80
F-test		**S**	**NS**	**S**
SE. d (+)		0.55	0.40	0.48
CD (5%)		1.17	0.86	1.02

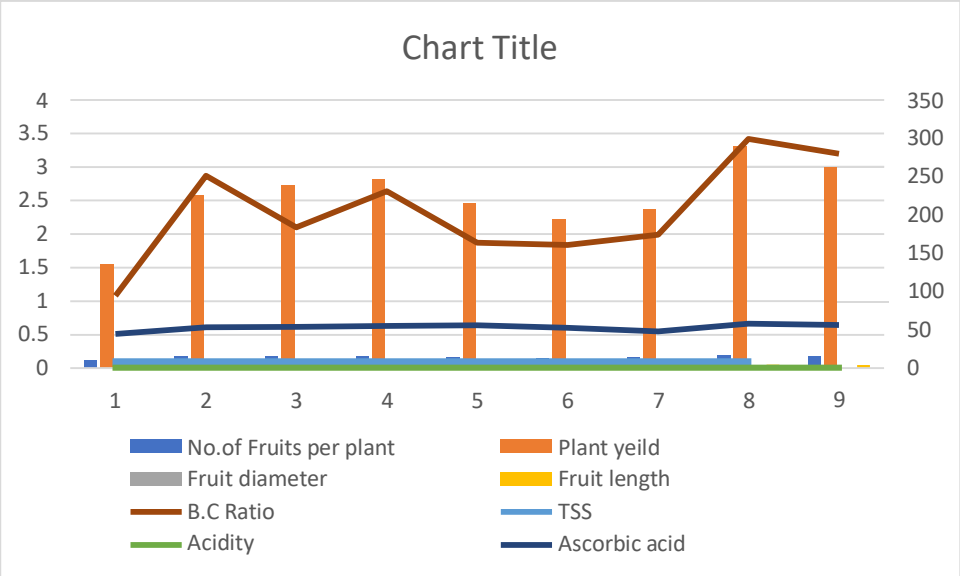
YIELD AND ECONOMIC ATTRIBUTES

From the (Table 2) & (Graph 2) the earliest flowering was observed in 42.17 days after planting due to the nutritional combination of organic and inorganic sources as (30%) Vermicompost + (30%) FYM + (40%) NPK. These resulted are supported by (Abu-Zahra and Tahboub, 2008) who observed the early flowering by application of organic matter Muhammad Ahsan Altaf in 2019 observed the addition of organic manure to NPK increases the uptake of nutrients (N, P, K, Ca, S, and Fe) as compared to control. Flowering in strawberry plants is related to the plant's water regime and nutritional condition. Fertilization around the blooming time increases the number of crowns, resulting in more inflorescences. The increase in photosynthate production as a result of phosphorus content in farm yard waste, which assisted in breaking bud hibernation and increasing blooming sites Odongo *et al*. (2008). Plants treated with (30%) FYM + (30%) Vermicompost + (40%) NPK produced maximum number of flowers with 20.26 and followed by (20%) FYM + (20%) Vermicompost + (60%) NPK with (19.13), minimum was recorded as in Water Control +NPK. Herencia *et al*. (2011) evaluated the influence oforganic fertilized soils on strawberry blooming and fruiting and discovered that strawberry vegetative phases completed earlier on farm yard manure and vermicompost, resulting in an earlier commencement of reproductive stage.

Vermicompost treatments improved strawberry blooming and fruiting, according to Arancon *et al*. (2003) soil qualities such as cation exchange capacity and nutrient availability are improved by vermicomposting. Number of fruits per plant 17.31 was recorded with (30%) Vermicompost + (30%) FYM + (40%) NPK followed (30%) Vermicompost + (30%) FYM + (40%) NPK as compared to other treatments but observed at par with treatment (75%) FYM+ (25%) NPK and Control + NPK gave the minimum results. (Tagliavini *et al.* 2005) discovered that nitrogen availability increased the number of crowns per plant, flower size, and fruit output, and decreased abortion of female floral parts. Fruits are the primary nitrogen, phosphorus, and potassium sinks for strawberries to satisfy the high nutritional requirements of strawberry plants, food availability during blooming should be moderate but consistent (Mahadeen, 2009). (30%) FYM + (30%) Vermicompost + (40%) NPK resulted maximum fruit weight of 17.26 was followed by 16.74 through the plants treated with (20%) Vermicompost + (20%) FYM + (60%) NPK Minimum fruit weight of 10.50 in Water Control +NPK. Manures include beneficial levels of macro and micro nutrients and increase fruit weight through carbohydrate synthesis. These findings are consistent with those of Odongo *et al*. (2008), who found organic manure has significant effect on the berry size and yield. Maximum yield of 289.39g was recorded with (30%) FYM + (30%) Vermicompost + (40%) NPK followed by (20%) Vermicompost + (20%) FYM + (60%) NPK having 262.87 and minimum yield of 135.64g was found in control T_0 Water Control +N.PK. The results agreed with Kumar *et al*. (2015) found that treatments combining organic and inorganic manure had a substantial influence on most vegetative growth metrics, fruit setting, and Quality in strawberry plants.

Table 2: Effect of organic and inorganic sources on yield characters and yield plant^{-1} of strawberry

Treatment	Treatment combinations	Number of fruits per plant (90 days)	Yield per plant (g) (90 days)	Fruit Diameter (cm) (90 days)	Fruit length (cm) (90 days)	TSS (^{0} brix) (90 days)	Acidity (%) (90 days)	Ascorbic acid (mg/100g)	Net return (Rs./100^2)	Benefit : cost ratio
T0	Water Control +NPK	10.97	135.64	2.15	2.60	7.27	0.77	44.74	4,18,400	1.08
T1	50%FYM + 50% NPK	14.94	225.16	2.95	3.69	8.83	0.66	53.6	11,14,000	2.87
T2	50% Vermicompost + 50% NPK	15.77	238.39	2.58	3.55	8.77	0.7	54.13	9,07,200	2.10
T3	75% FYM+ 25% NPK	15.63	247.00	2.76	3.64	8.56	0.68	55.06	10,26,000	2.64
T4	75%Vermicompost + 25% NPK	14.32	215.30	3.14	4.39	5.65	0.63	56.20	8,52,800	1.87
T5	25%FYM + 75% NPK	13.03	194.90	2.38	3.14	7.71	0.75	52.88	7,53,600	1.84
T6	25%Vermicopost + 75% NPK	14.19	206.78	2.43	3.23	8.40	0.72	48.24	8,16,800	1.99
T7	30%Vermicompost + 30% FYM + 40% NPK	17.31	289.39	3.66	4.61	9.29	0.62	58.10	14,21,000	3.42
T8	20%FYM + 20% Vermicompost + 60% NPK	16.16	262.87	3.38	4.48	9.13	0.64	56.68	13,11,000	3.20
F-test		**S**	**S**	**S**	**S**	**S**	**S**	**S**		
SE. d (+)		0.48	19.01	0.37	0.17	0.29	0.02	0.73		
CD (5%)		1.03	40.30	0.77	0.37	0.62	0.05	1.54		



Graph 2: Effect of organic and inorganic sources of nutrition on yield characters and yield plant^{-1} of strawberry

CONCLUSION

Based on the present investigation 2020-2022, it is concluded that treatment T_7 (30%Vermicompost + 30% FYM + 40% NPK). recorded maximum performance with respect to all the vegetative growth as well as yield characteristics as plant height(cm), plant spread(cm), number of leaves, number of flowers, average fruit weight(g), fruit length(cm), fruit density, no.of fruits per plant, yield per plot(g), yield t/ha, TSS, minimum acidity and days for flowering, maximum ascorbic acid mg/100g. Considering yield sustainability, ecosystem balance, soil health improvement and cost benefit ratio found (1:3.42) in T_7 (30%Vermicompost + 30% FYM + 40% NPK), followed by 3.20 in by T_8 which are effectively recommended for strawberry.

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