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EFFECT OF MULCHING AND PGRS ON GROWTH, YIELD AND ECONOMICS OF STRAWBERRY (*Fragaria ananassa* Duch.) CV. DOUGLAS

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ABSTRACT

Effect of different mulches and PGRs on growth ,flowering ,fruiting, yield and benefit cost ratio of strawberry (*Fragaria ananassa* Duch.) cv. Douglas was studied at Ranchi (Jharkhand) during 2007-08 and 2008-09 .Nineteen treatments (GA_3 (25, 50, 100 ppm) with black polyethylene mulch, GA_3 (25, 50, 100 ppm) with transparent polyethylene mulch, GA_3 (25, 50, 100 ppm) with paddy straw mulch , NAA (10, 20, 40 ppm) with black polyethylene mulch, , NAA (10, 20, 40 ppm) with transparent polyethylene mulch, , NAA (10, 20, 40 ppm) with paddy straw mulch along with one control. The result revealed that the different mulching with PGR application significantly affects the plant growth and yield of fruit. Maximum plant height (23.26 cm), East West spread (32.02 cm) , North South spread (32.08 cm), maximum number of flower (38.21/plant), minimum days taken to first flowering (62.88 days), First fruit set (4.10 days), early maturity of fruits (19.05 days), early harvesting (81.61 days), number of fruit (27.40/plant),yield (349.01 g/plant),yield (6.10 kg/plot), yield(81.32 qt/ha) and maximum benefit cost ratio was 1.62 as per the recorded observations on GA_3 100 ppm + Black polyethylene mulching (T_3).

Key words : Strawberry, Mulching, PGRs, Growth, Yield, Economics

INRTRODUCTION

Strawberry (*Fragaria ananassa* Duch.) of Rosaceae family is one of the most delicious and refreshing soft fruit of the world. The fruits are widely acclaimed for pleasant flavor, conspicuous colour and varied blend of taste. Strawberry fruits are in great demand for fresh market as well as in processing industries for the use in preserves and confectioneries (Rana and even at high altitude of tropical climate. The strawberry plants require adequate soil moisture and weed free field during whole crop period. Strawberry is a surface feeder and hence mulching play very important role in soil moisture conservation weed control, regulation of soil hydrothermal regime, besides keeping the delicate fruit

hormones have been applied to improve fruit quality and quantity of various horticultural crops (Beech *et al.*, 1988; Caruso,1997; Wang *et al.*,1998; Hasan *et al.*,2000 and Moor *et al.*,2004). Therefore, an investigation was undertaken to standardize the appropriate mulching material with plant growth regulators for vegetative growth and fruit yield of strawberry cv. Douglas.

MATERIALS AND METHODS

A field experiment on strawberry cv. Douglas was conducted during 2007-08 and 2008-09 at Birsa Agricultural University, Kanke, Ranchi (23°17' N and 85°19' E at 625m above mean sea level). The soil was Alfisol having sandy loam texture with pH 5.77, organic carbon 0.54%,available N 332.5 kg ha^{-1}, available P_2O_5 31.82 kg ha^{-1}, available K_2O 142.65 kg ha^{-1}. The experiment was laid out in a Randomized Block Design (RBD) with nineteen treatment combinations each replicated three times with twenty five plants per plot. Runners of Strawberry were planted at spacing of 0.60m×0.50m. The uniform dose of FYM 25t ha^{-1}, and N (20 kg ha^{-1}) as Urea, P_2O_5 (80 kg ha^{-1}) as SSP and K_2O (40 kg ha^{-1}) as MOP were applied at the time of field preparation as per treatments and rest N (20 kg ha^{-1}) applied at the time of flowering stage. Black and transparent polyethylene of 200 gauge(Rs.15/sqm) and paddy straw(Rs.4/sqm) were spread in plots which were 6 cm in thickness. Solution of GA_3(Spraying cost for 25ppm-Rs3500, 50ppm-Rs7000 and 100ppm-Rs14000) and NAA (Spraying cost for 10ppm-Rs875, 20ppm-Rs1750 and 40ppm-Rs3500) were thoroughly sprayed with high volume hand sprayer till solution started dripping from leaves after 115 days and 130 days of were applied. The observations were recorded on various parameters like plant height, plant spread, number of flower/ plant, flowering duration, fruit set, fruit maturity, harvesting, number of fruit/plant, yield and gross returns, net returns/ha and B:C ratio. The statistical analysis of data of two year were pooled by the weighted mean method as described by Nigam and Gupta (1979).

RESULTS AND DISCUSSION

Growth parameter :

The plant growth characteristics like plant height, plant spread N-S and E-W directions (Table 1) were significantly influenced by the application of mulching and plant growth regulators. The maximum plant height (23.26cm) ,maximum plant spread N-S direction(32.08 cm)and maximum E-W direction (32.02cm) was observed in T_3 (GA_3 100 ppm + Black polythene).The possible reasons for increased plant height, plant spread N-S and E-W direction might be due the application of mulching and PGRs treatments which led to congenial environment in root zone due to lower weed population, optimum soil moisture level, increased availability of nutrients and favourable soil temperature which regulated growth of strawberry plant by causing cell elongation and corresponding increase in length of petiole by application of GA_3.These results are in consonance to that of Aulakh and Sur (1999) in pomegranate, Mohanty *et al.* (2002) in mandarin, Shirgure *et al.* (2003) in mandarin, Sharma and Sharma (2003),Khokhar *et al.* (2004) and Sharma *et al.* (2004) in strawberry.

Reproductive characters :

Table 1. Effect of mulching and plant growth regulators on growth and yield of strawberry

Treatment	Plant height (cm)	Plant spread N-S (cm)	Plant spread E-W (cm)
T_1-GA_3 25 ppm+Black polythene	21.11	29.23	29.41
T_2-GA_3 50 ppm+Black polythene	22.72	31.68	31.49
T_3-GA_3 100 ppm+Black polythene	23.26	32.08	32.02
T_4-GA_3 25 ppm+Transparent polythene	20.91	28.58	28.82
T_5-GA_3 50 ppm+Transparent polythene	21.43	30.21	30.12
T_6-GA_3 100 ppm+Transparent polythene	22.19	30.71	30.82
T_7-GA_3 25 ppm+ Paddy straw	19.77	27.40	27.85
T_8-GA_3 50 ppm+ Paddy straw	19.97	27.98	28.15
T_9-GA_3 100 ppm+ Paddy straw	20.63	28.26	28.49
T_{10} NAA 10 ppm+Black polythene	18.72	24.93	26.28
T_{11} NAA 20 ppm+Black polythene	19.42	26.89	27.45
T_{12} NAA 40 ppm+Black polythene	17.19	22.90	24.70
T_{13}-NAA 10 ppm+Transparent polythene	18.52	24.33	25.93
T_{14}-NAA 20 ppm+Transparent polythene	19.22	26.63	26.98
T_{15}-NAA 40 ppm+Transparent polythene	17.37	23.29	25.00
T_{16}-NAA 10 ppm+ Paddy straw	18.18	24.10	25.61
T_{17}-NAA 20 ppm+ Paddy straw	18.99	25.34	26.81
T_{18}-NAA 40 ppm+ Paddy straw	17.75	23.66	25.27
T_{19}-Control	16.26	21.38	21.23
CD (P=0.05)	3.59	5.06	4.93

of flower, flowering duration, first fruit set, fruit maturity and harvesting have been presented in Table 2. The maximum number of number of flower (38.21) and flowering duration (62.56 days) were recorded with GA_3 100 ppm + Black polyethylene mulching (T_3).The more number of flowers per plant and earliness in flowering were probably because of hormone application which accelerated the development of differentiated inflorescence and stimulated flowering. Mulching provided optimum soil moisture and temperature thus creating due to GA_3 and black polyethylene mulch were also reported by Thakur *et al.* (1991), Gupta and Acharya (1993), Kumar *et al.* (1996), Khokhar *et al.* (2004), Singh *et al.* (2005) and Ali and Gaur (2007) in strawberry.

The first fruit set (4.10 days), fruit maturity (19.05 days) and harvesting (81.61 days) were recorded with GA_3 100 ppm + Black polyethylene mulching (T_3). The increased fruit set, early fruit maturity and early harvesting may be due to the GA_3 stimulus involvement in fruit set which

Table 2. Effect of mulching and plant growth regulators on reproductive character of strawberry

Treatment	Number of flower/ plant	Flowering duration (days)	Days taken to fruit (days)	Days taken to fruit maturity (days)
T_1-GA_3 25 ppm+Black polythene	36.40	64.39	4.61	21.40
T_2-GA_3 50 ppm+Black polythene	37.96	62.88	4.19	19.24
T_3-GA_3 100 ppm+Black polythene	38.21	62.56	4.10	19.05
T_4-GA_3 25 ppm+Transparent polythene	35.84	64.54	4.68	21.81
T_5-GA_3 50 ppm+Transparent polythene	37.03	63.51	4.53	20.96
T_6-GA_3 100 ppm+Transparent polythene	37.22	63.25	4.40	19.83
T_7-GA_3 25 ppm+ Paddy straw	33.15	65.65	4.98	22.47
T_8-GA_3 50 ppm+ Paddy straw	34.06	65.51	4.88	22.22
T_9-GA_3 100 ppm+ Paddy straw	35.20	65.21	4.74	22.12
T_{10} NAA 10 ppm+Black polythene	27.82	66.90	5.45	23.91
T_{11} NAA 20 ppm+Black polythene	31.93	66.07	5.16	22.80
T_{12} NAA 40 ppm+Black polythene	20.83	69.79	5.72	25.87
T_{13}-NAA 10 ppm+Transparent polythene	26.65	67.32	5.54	24.02
T_{14}-NAA 20 ppm+Transparent polythene	30.65	66.20	5.28	23.06
T_{15}-NAA 40 ppm+Transparent polythene	22.53	69.38	5.67	25.14
T_{16}-NAA 10 ppm+ Paddy straw	25.59	67.69	5.58	24.16
T_{17}-NAA 20 ppm+ Paddy straw	29.59	66.77	5.36	23.30
T_{18}-NAA 40 ppm+ Paddy straw	24.98	68.51	5.63	24.45
T_{19}-Control	18.10	74.64	5.77	27.15
CD (P=0.05)	6.43	5.34	0.46	1.73

pollen substances is a co-enzyme or activator of enzymatic systems present in the ovary, which liberate active hormones from the storage pools (Muir, 1947). Black polyethylene mulch probably led to increase canopy temperature, soil temperature and moisture contents, these might have affected on earlier fruit set, development of fruit and early harvesting. Petrovskaya (1975), Singh *et al.* (2005), Ali and Gaur (2007) in strawberry.

Yield attributes :

The number of fruit per plant, fruit yield per plant (g), fruit yield per plot (kg) and fruit yield (q/ha) were significantly affected by application of Mulching and plant growth regulators (Table 2). The

maximum fruit yield (6.10 kg/ plot) and maximum fruit yield (81.32 q ha^{-1}) were recorded with GA_3 100 ppm + Black polyethylene mulching (T_3). The higher yield may be due to increased flowering and more fruit set and higher fruit weight. The results are in agreement with the observation of Kumar *et al.*(1996), Khokhar *et al.* (2004) and Singh *et al.* (2005) in strawberry.

Economics :

Economics of strawberry cultivation revealed that the higher cost of cultivation involved in the treatment where plant treated with mulching and plant growth regulators, but it could exhibit higher net returns (Table 3). GA_3 100 ppm + Black polyethylene mulching (T_3) treatment gave highest net returns (10,04,484 Rs. ha^{-1}) and highest B:C ratio (1.62) .

Table 3. Effect of mulching and plant growth regulators on yield attribute of strawberry

Treatment	Days taken to harvesting	No. of fruit/ plant	Yield/ plant (g)	Yield/ plot (kg)	Yield (q/ha)
T_1-GA_3 25 ppm+Black polythene	85.79	23.95	275.91	5.44	72.50
T_2-GA_3 50 ppm+Black polythene	82.12	26.55	329.07	5.95	79.36
T_3-GA_3 100 ppm+Black polythene	81.61	27.40	349.01	6.10	81.32
T_4-GA_3 25 ppm+Transparent polythene	86.34	23.05	265.68	5.25	70.02
T_5-GA_3 50 ppm+Transparent polythene	84.47	24.54	289.69	5.56	74.18
T_6-GA_3 100 ppm+Transparent polythene	83.08	24.77	295.35	5.80	77.29
T_7-GA_3 25 ppm+ Paddy straw	88.12	21.41	237.04	4.84	64.49
T_8-GA_3 50 ppm+ Paddy straw	87.73	21.99	253.09	4.94	65.90
T_9-GA_3 100 ppm+ Paddy straw	87.33	22.58	261.93	5.12	68.27
T_{10} NAA 10 ppm+Black polythene	90.81	17.91	184.51	4.51	60.07
T_{11} NAA 20 ppm+Black polythene	88.87	20.97	225.79	4.76	63.53
T_{12} NAA 40 ppm+Black polythene	95.66	10.07	96.92	3.85	51.31
T_{13}-NAA 10 ppm+Transparent polythene	91.33	16.49	168.64	4.38	58.44
T_{14}-NAA 20 ppm+Transparent polythene	89.26	20.49	216.41	4.68	62.43
T_{15}-NAA 40 ppm+Transparent polythene	94.52	11.56	112.58	4.03	53.74
T_{16}-NAA 10 ppm+ Paddy straw	91.85	14.67	148.05	4.32	57.54
T_{17}-NAA 20 ppm+ Paddy straw	90.07	18.70	194.14	4.61	61.45
T_{18}-NAA 40 ppm+ Paddy straw	92.96	13.51	134.15	4.20	56.03
T_{19}-Control	101.78	8.92	80.90	3.09	41.21
CD (P=0.05)					

ffect of mulching and plant growth regulators on economics of strawberry

ments	Cost of cultivation for both year				
	Total cultivation cost (Rs.)	Total yield q/ha	Gross income (Rs./ha)	Net profit (Rs./ha)	B:C ratio
'5 ppm+Black polythene	600880	145.00	1449973	849093	1.41
'0 ppm+Black polythene	607880	158.71	1587147	979267	1.61
00 ppm+Black polythene	621880	162.64	1626364	1004484	1.62
'5 ppm+Transparent polythene	600880	140.03	1400302	799422	1.33
'0 ppm+Transparent polythene	607880	148.36	1483556	875676	1.44
00 ppm+Transparent polythene	621880	154.57	1545707	923827	1.49
.5 ppm+ Paddy straw	615880	128.98	1289831	673951	1.09
.0 ppm+ Paddy straw	622880	131.80	1317956	695076	1.12
00 ppm+ Paddy straw	636880	136.54	1365351	728471	1.14
10 ppm+Black polythene	595630	120.14	1201436	605806	1.02
20 ppm+Black polythene	597380	127.05	1270542	673162	1.13
40 ppm+Black polythene	600880	102.61	1026116	425236	0.71
10 ppm+Transparent polythene	595630	116.87	1168711	573081	0.96
20 ppm+Transparent polythene	597380	124.86	1248551	651171	1.09
40 ppm+Transparent polythene	600880	107.47	1074720	473840	0.79
10 ppm+ Paddy straw	610630	115.07	1150738	540108	0.88
20 ppm+ Paddy straw	612380	122.90	1229013	616633	1.01
40 ppm+ Paddy straw	615880	112.07	1120693	504813	0.82
ol	408880	82.42	824213	415333	1.02

g market price of strawberry fruit: Rs.10,000/q

From the results, it can be concluded that GA_3 100 ppm + Black polyethylene mulching was found to be most effective in improving plant height, plant spread N- S and E-W direction, number of flower per plant, number of fruit per plant, yield, net monetary return, and highest benefit cost ratio. This recommendation can be followed for strawberry cultivation under chotanagpur region of Jharkhand.

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