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Studies on Trap cropping among Cole crops

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ABSTRACT: Vegetables are the important source of income for small land holding farming communities of India. The production and marketing is labour intensive, which creates job opportunities and support populated countries problems due to unemployment. Apart from that vegetables are rich source of vitamins, minerals and fats. India is the second leading producer of vegetables in the world. In India, it is grown in an area of 9.575 million hectares with the productivity of 17.7 MT/ha which contributes 14% of the total world production of vegetables. Among various states in India, West Bengal, Uttar Pradesh, Bihar, Madhya Pradesh, Odisha, Gujarat and Karnataka are the major vegetable growing states. West Bengal, Uttar Pradesh and Madhya Pradesh are the leader vegetables producer contributing nearly 40% to the total production of in the country, among which West Bengal contributing about 16% followed by Uttar Pradesh with 14% of total production of vegetables. Furthermore, Madhya Pradesh contributing about 8.6%, Bihar with 8.75%, Gujarat with 7%, Odisha with a 6%, Karnataka with 5%, Tamil Nadu and others with a 3.4% contribution in total production.

Among all winter vegetable grown in Indian States, Cole crops holds a most prominent and popular place becoming an inseparable part of daily diet of consumer. The Cole crop groups apart from yielding curds, heads and knobs also provides a considerable amount of biomass yield, which is further used as animal feed, organic composting, use as green mulch for other crop farming, use to produce vegetable oils, agriculture field use vegetable cakes prepared from residual substances & also organic vegetables are use for preparation of natural medicine in medicinal industries. Insects and pests are one of the major factors undermining to improve & safe vegetable production, decreases productivity & also decreases the marketability. Several control methods have been tried to overcome insects and pest attack to vegetables such as chemicals pesticides, organophosphorus & carbamate compounds which are found highly toxic & excess of it in vegetables deteriorates health & pollute environment. Intestinal human poisoning due to pesticides causes reduction in immunization & even up to death. Recently we face pandemic COVID – 19, which is affects the person having low immunization and having various health disorders.

Vegetables in general and Cole crops in particular are more vulnerable to such incidence because of the nature of maturity, habitat & there consumption perceptions. Many of this group of vegetables are harvested at very short intervals and are consumed raw with minimum processing. Now a day due to incidence of DBM (Diamond Back Moth) in Cole crops the quality & interest of consumer about use of Cole crops to some extent decreases and also case studies like dipping of harvested Cole crops in pesticide mix water is a barrier in marketing. That is why effective & low cost integrated pest management (IPM) is essential for healthy crop production. Integrated crop management practices such as trap cropping, crop inter cropping, crop habitat management, crop rotation, border cropping, crop husbandry are essential parameters to produce safe vegetables.Black cumin (**Nigella sativa L**) locally known as Kala jeera / Mangrella comes under family Ranuneulaceae is a seed spices herbs cultivating in most of the places such as Punjab, WB, Assam, Bihar, Odisha India are used as spice & condiments. In the present research **Nigella sativa L** is used as trap crop around the small plots border of Cole crops such as Cabbage **(Brassica oleracea Lvar. capitata)** , Cauliflower **(Brassica oleracea L var. botrytis)** & Knoll khol **(Brassica caulorapa L)** to study the extent of reduction in major pest like DBM, to find out the feasibility of black cumin as trap crop among Cole crops, to observe the companionship of different Cole crops with trap crop & economical analysis of trap cropping for further extension of this technology.

This experiment was carried out by author under dissertation work of pot graduate in horticulture (vegetable science) SHIAT, U.P. and replicate in eastern India state Odisha to find the suitability & profitability of trap crop **Nigella sativa L** among Cole crops by standardized few agro-techniques such as planting the Black cumin in border of Cole crop The result of the experiment reflect that out of three treatments crop combination all most all treatments congregate the objective of the study and provide significance to their vegetative & reproductive performances. Knol Khol + Black cumin in border as trap crop combination results best performances in various aspects such as vegetative growth, yield, resistant to insect pest incidence & economic performances. Main crop vegetative growth found best plant height (cm) with trap crop Black cumin.So transplanted Black cumin is an efficient trap crop among Cole crops and trap cropping is a best practice for integrated pest management,

suitable mechanism and effective methods of waste space management which increases productivity of land. Other trap crops such as marigold, onion, coriander, mustard, fenugreek, fennel, sun flower etc. are also efficient to reduce insect pests from Cole crops.

KEY WORD: Trap cropping; Black cumin; integrated pest management in vegetables; Cole crops

I. MATERIALS & METHODS:

This experiment was carried out by author under dissertation work of pot graduate in horticulture (vegetable science) SHIAT, U.P. and replicate in eastern India state Odisha to find the suitability & profitability of trap crop **Nigella sativa L** among Cole crops by standardized few agro-techniques such as planting the Black cumin in border of Cole crop, plot of size Plant X Row is equal to 2m X 2m. Mechanical analysis of soil was done before experiment to know the initial soil status by random soil sampling method. The soil was found Sand 45 %, Silt 19 % & Clay 36 %. The soil organic matter was estimated by hydrochloric acid oxidation method (as suggested by Walklay & Black 1971). Chemical analysis found 0.480 & organic carbon, 0.050% organic matters, 0.039% available nitrogen, 0.625 % available phosphorus & 0.625 % available potash. The experimented plot was exclusively utilised for vegetables before experiment. All total three(3) trap cropping treatments with seven replications taken in the experiment such as T1 is Cabbage + Black cumin in border combination, T2 is Cauliflower + Black cumin in border combination, T3 is Knol Khol + Black cumin in border combination. The experiment data are analyses in Randomized Block Design (RBD) from 21 numbers of plots of size Length X Breadth is 2m X 2m with recommended spacing that is cabbage (Improved HK) 60cm. X 45 cm., Cauliflower (Improved SB) 45 cm. X 45 cm., Knol Khol (Improved EWV) 30cm. X 30 cm. & Black cumin (Local strain) 30cm. X 30 cm. and with standard dose of fertilizer. All four crops vegetable & harvesting parameters data are recorded and analyses

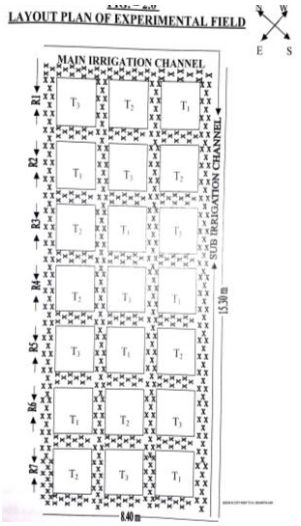


Table -1 Vegetative growth of all four crop treatments at the time of Full maturity:

Crop Treatments	Average Mean Plant height (cm.) during harvesting	Average mean numbers of leaf per plant at the time of harvesting (nos.)	Average mean spread / plant at the time of harvesting (cm.)
Cabbage (C1)	35.37	14.35	49.68
Cauliflower (C2)	57.44	24.28	67.06
Knol Khol (C3)	50.06	16.66	**72.01**
Black Cumin (B)	**64.17**	**82.51**	16.86
Significant level SEm+	**1.06**	**1.01**	**0.98**
CD (P=0.05)	**2.22* Significant**	**2.12* Significant**	**2.07* Significant**

Table no. 1 shows the plant height clearly at maturity stage of all four crops that is C1, C2, C3 & B and Black cumin found highest height during maturity among all four crops that is 64.17 cm followed by C2 57.44 cm, C3 50.06 cm & C1 35.37 cm. As far as average mean numbers of leaf per plant is concern B recorded maximum numbers of leaf that is 82.51 at the time of full maturity followed by C2 24.28 numbers, C3 16.66 numbers & C1 14.35 numbers of leaf and there are significant differences of the numbers of leaf of four crops treatments. Average spread per plant found maximum in C3 that is 72.01 cm. followed by C2 67.06 cm., C1 49.68 cm., & B scored minimum spread per plant at the time of maturity that is 18.86 cm.

Table – 2 Yield Parameters:

Crop Treatments	*Average mean Weight of Head/Curd/Knob/ Seeds per plant (grams)*	*Yield (t/ha)*
Cabbage (C1) - Head	***1799.99***	***54.45***
Cauliflower (C2) - Curd	*0921.19*	*32.40*
Knol Khol (C3) - Knob	*0452.30*	*16.90*
Black Cumin (B)- Seeds	*0007.33*	*0.80*
Significant level SEm+	***45.86***	***8.72***
CD (P=0.05)	***94.68* Significant***	***18.32* Significant***

Table no. 2 shows the average mean weight of Head / Curd / Knob / Seeds per plant in grams where C1 recorded maximum weight per plant that is 1799.99 grams followed by C2 921.19 grams, C3 452.30 grams & B 7.33 grams seed per plant. As far as yield per hectare is concern C1 found highest yield that is 54.45 t/ha followed by C2 32.40 t/ ha, C3 16.90 t/ha & trap crop Black cumin (B) seed yield is 0.80 t/ha.

Table – 3 Performance of Trap crop Nigella sativa L (Black cumin) with different treatment crop combination.

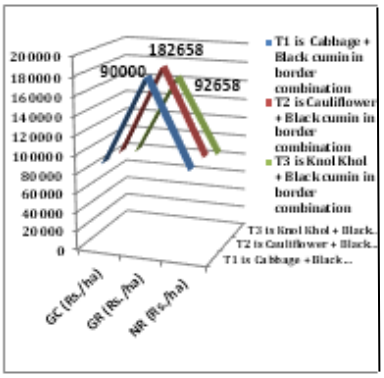
Treatments	**Black cumin Average mean Plant height 90 Days after trans planting / DAT (cm)**	**Average nos. of seed pod per plant at the time of harvesting of Black cumin (Nos.)**	**Average mean Seed yield (t/ha) of Black cumin**	**Incidence of Insects & Pest (DBM) in % (Random sample Score card method)**
T1 is Cabbage + Black cumin in border combination	65.79	97.71	0.64	10
T2 is Cauliflower + Black cumin in border combination	**67.67**	101.00	0.62	05
T3 is Knol Khol + Black cumin in border combination	59.05	**106.57**	**1.13**	**00**
Significant level SEm+	**1.82**	**3.28**	**0.09**	**Average = 5%**
CD (P=0.05)	**3.97* Significant**	**7.14* Significant**	**0.20* Significant**	

Table number 3 represent the plant height of trap crop Black cumin with main crops and found best growth at 90 DAT with T2 that is 67.67 cm followed by T1 65.79 cm & T3 59.05 cm respectively and there is significant difference among the treatments. As far as numbers of seed pods of Black cumin at the time of harvesting is concern it is found best with treatment combination T3 is Knol Khol + Black cumin in border combination that is 106.57 nos. of seed pods per plant followed by T2 101.00 nos. of pods per plant & T1 97.71 nos. of pods per plant respectively. Yield of black cumin t/ ha found best with T3 that is 1.13 t/ha followed by T1 0.64 t/ ha & T2 0.62 t/ha respectively.

Incidence of Insects & Pest (DBM) in % calculated by adopting Random sample score card method and it was found DBM incidence nil with treatment T3 that is 0% followed by T2 5 % and T1 crop combination found highest incidence of DBM that is 10%. More over on an average incidence was found that is 5 % which is negligible and highlighted **Nigella sativa** as suitable trap crop for Cole crops.

II. ECONOMICS OF THE EXPERIMENTS:

Treatments	*Gross Cost of Cultivation GC (Rs./ha)*	*Gross Return from Cultivation GR (Rs./ha)*	*Net Return NR (Rs./ha)*	*BC ratio*
T1 is Cabbage + Black cumin in border combination	*90000*	*180908*	*90908*	*2.01*
T2 is Cauliflower + Black cumin in border combination	*90000*	*182658*	*92658*	*2.02*
T3 is Knol Khol + Black cumin in border combination	*80000*	*164198*	*84198*	*2.05*



The economics of the experiment on "Studies on trap cropping among Cole crops" reflects that among all crop combination treatments T3 - Knol Khol + Black cumin in border combination results best economic performance with **BC** ratio of **2.05** due to less cost of cultivation & short crop duration as well as occupying maximum plant populations in similar field with closer recommended spacing followed by **T2** - Cauliflower + Black cumin in border combination **with BC ratio 2.02** & **T1** - Cabbage + Black cumin in border combination **BC ratio 2.01**.

III. CONCLUSION:

The result of the experiment reflect that out of three treatments crop combination all most all treatments congregate the objective of the study and provide significance to their vegetative & reproductive performances. T3 - Knol Khol + Black cumin in border as trap crop combination results best performances in various aspects such as vegetative growth, yield, resistant to insect pest incidence & economic performances. Whereas as main crop vegetative growth found best plant height (cm) with trap crop Black cumin followed by C3, C2 & C1 and spread of plant found best with C3 followed by C2, C1 & trap crop Black cumin & as far as yield is concern C1 (Cabbage) has highest yield (t/ha) followed by C2 (Cauliflower), C3 (Knol Khol) & Black cumin. So transplanted Black cumin is an efficient trap crop among Cole crops and trap cropping is a best practice for integrated pest management, suitable mechanism and effective methods of waste space management which increases productivity of land. Other trap crops such as marigold, onion, coriander, mustard, fenugreek, fennel, sun flower etc. are also efficient to reduce insect pests from Cole crops.

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