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# Influence of Intercrops and Cow - Urine Plant Extracts on the Incidence of *Plutella xylostella* Linn., *Pieris brassicae* Linn. and *Brevicoryne brassicae* Linn. in Cabbage

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**Abstract**

Two field trials were carried out to study the effect of intercropping and cow-urine plant extracts on the incidence of *Pieris brassicae* Linnaeus, *Plutella xylostella* Linnaeus and *Brevicoryne brassicae* Linnaeus in cabbage. The results revealed that the minimum incidence of *P. brassicae*, *P. xylostella* and *B. brassicae* was observed in cabbage intercropped with marigold registering mean population of 4.02, 4.20 and 50.70 insects/plant, respectively, and maximum population was recorded when cabbage grown with broad bean recording mean population of 8.23, 9.87 and 63.40 per plant, respectively compared 11.24, 9.92 and 71.47 per plant on cabbage as sole crop. The plots of cabbage intercropped with marigold yielded highest (17.30 t/ha) with net-return of Rs 51, 900/ha followed by tomato (Rs 50, 100/ha) and garlic (Rs 46,050/ha) with their corresponding additional return over cabbage sole crop of Rs 54,300, Rs 49,550 and Rs 28, 200/ ha, respectively. The results of insecticidal evaluation indicated that the plots treated with dichlorvos at 500 a. i./ha resulted in significant reduction of butterfly, moth and aphid recording lowest incidence of 1.11, 4.16 and 11.64 insects/plant compared to 11.40, 19.71 and 40.23 insects/plant, respectively in untreated control plots. Dichlorvos was at par with calpaste at 1, 500 g/ha for *P. brassicae*, while it was at par with *Jatropha gossypifolia* extract at 12500 ml/ha for *P. xylostella*. The treatments with *V. trifolia* and *Acorus calamus* showed their inferiority over rest of the test compounds with a record of maximum butterfly larvae, moth larvae and aphid population. The highest mean yield (23.51 t/ha) was recorded from dichlorvos treated plots followed by the plots treated with calpaste (22.76 t/ha), cal-10 (21.95 t/ha), *Melia azedarach* (21.21 t/ha), cal-MB (20.11 t/ha) and *J. gossypifolia* (19.60 t/ha) compared to 17.63 to 18.11 t/ha in the rest of the five insecticidal treatments and 13.95 t/ha in untreated control. The extent of avoidable yield loss due to the incidence of butterfly, moth and aphid was estimated to be 40.66% in untreated check which was reduced to 3.19 (calpaste) —24.67% (*A. calamus*) in different insecticidal treatments.

**Key words : Cabbage, Intercrops, Cow-urine plant extracts, Efficacy, Insect pests Yield.**

Cabbage is prone for infestation by a number of insect pests consisting of sucking and defoliating insects at all the stages of the crop. In Manipur, 12 species of insect pests have been observed to inflict damage in cole crops starting from seedlings to harvesting stage of crop growth, of which doamond back moth (DBM), *Plutella xylostella* Linnaeus, cabbage butterfly (CB), *Pieris brassicae* Linnaeus and cabbage aphid (CA), *Brevicoryne brassicae* Linnaeus are the most important and regular pests of cabbage crop in the state (1). Monocropping of cabbage sometimes fails due to its major pest causing 52% loss in marketable yield and loss could be more than 80% particularly due to *P. xylostella* when attack is severe. Several broadspectrum synthetic organic insecticides are usually recommended for the effective control of these pests (2). However, these compounds are known to evoke multifarious problems including environmental pollution, health hazards, destruction of beneficial fauna like parasitic, predatory and pollinating insects, resistance to insecticides and resurgence of secondary insect pests. Moreover, excessive use of such persistent insecticides on vegetable is acquiring a special concern since there is a little time lag between the last application and consumption. Owing to wide spectral problems with the use of these insecticides, cultural practices like intercropping and use of bio-rational insecticides are gaining popularity in integrated pest management (IPM) program because of their safety to non-targeted organ-

ism and non-biomagnification in the food chain. keeping this in view, the present investigation was carried out to study the effect of six intercrops and certain phyto-products on the incidence of *P. brassicae*, *P. xylostella* and *B. brassicae* in cabbage.

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## Methods

With a view to assess the effect of intercropping on the incidence of the cabbage butterfly (CB), *Pieris brassicae* Linnaeus, the diamond back moth (DBM), *Plutella xylostella* Linnaeus and the cabbage aphid (CA), *Brevicoryne brassicae* Linnaeus, a field trial was laid out in the randomized block design. The cabbage variety Pride of India was grown alone (sole crop) and intercropping with onion (var N 53) and garlic (var local) in 1 : 2 ratio and marigold (var Local dwarft), broad bean (var Local) potato (var Kufri Jyoti) and tomato (var Nithi) were grown in 1 : 1 ratio. Altogether, there were seven treatments, each replicated thrice. The plot size, intra and intra-spacing for the cabbage were 4 ×3 $m^2$, 45 cm and 45 cm, respectively. No plant protection measures were exercised during the period of experiment. Observations on the number of larvae for *P. xylostella* and *P. brassicae* plant, and aphid population on three leaves (top, middle and bottom/plant) on five randomly selected plants from each plot were recorded at weekly intervals starting from second week after transplanting till the day before harvest. The yield of both cabbage and intercrops from each plot was recorded and computed in tonnes per hectare. For insecticidal evaluation against the pests, a separate field experiment was laid out in randomized block design with 11 treatments including one untreated control each replicated three times. The plot size, row to row and plant to plant spacing were 4 × 3 $m^2$, 45 cm and 45 cm, respectively with path of 1.0 m. All the spray treatments were applied thrice at 10-day intervals commencing from appearance of pests. The relative field efficacy of the test insecticides was determined by recording the larval population of *P. xylostella* and *P. brassicae* per plant, and aphid population on three leaves (top, middle and bottom) per plant at one day before and 1, 3,5, 7 and 10 days after each application of insecticides from five randomly selected plants in each plot. Plot-wise cabbage yield was recorded and then computed in tonnes per hectare. The avoidable yield loss due to the pests in different treatments was estimated by using formula suggested by Pawar et al. (3).

## Results and Discussion

### *Effect of Intercrops on the Incidence of Insect Pests*

A great deal of variation in the incidence of the cabbage butterfly (CB), *Pieris brassicae* Linnaeus, the diamond back moth (DBM),*Plutella xylostella* Linnaeus, and the cabbage aphid (CA), *Brevicoryne brassicae* Linnaeus was observed in the cabbage crop intercropped with different intercrops (Table 1). Amongst the six cabbage based intercrops, the intercrop cabbage + marigold resulted in minimum butterfly larvae (4.02/plant), diamond back moth larvae (4.20/plant) and aphid population (50.70/plant ) followed by garlic, tomato and onion. The results further indicated that broad bean as intercropped with cabbage was ineffective in reducing the number of DBM larvae on cabbage. Similar opinion has been given by Talekar et al. (4) and Singh et al. (5) who studied 504 intercrops with cabbage and reported that the intercrop treatments with marigold, tomato, garlic, safflower, oat and barley significantly reduced the number of DBM larvae in cabbage. The intercrop, cabbage + broad bean showed highest incidence of cabbage butterfly (8.23 larvae/plant), diamond back moth (9.87 larvae/plant) and cabbage aphid (63.40/plant).

The plots of cabbage intercrop with marigold yielded highest of 17.30 t/ha with an net return of Rs 51,900/ha followed by tomato (Rs 50, 100/ha), garlic (Rs 46,050/ha) with their corresponding additional return over cabbage sole crop of Rs 54,300, Rs 49, 550 and Rs 28,200/ha, respectively (Table 2). The results obtained here is in accordance with the observations Singh et al. (5) who reported that the plots intercropped with marigold yielded highest cabbage yield of 186.33 q/ha with a net return of Rs 55, 899/ha followed by methi, mustard, coriader and tomato.

### *Effect of Cow-Urine Plant Extracts on the Incidence of Insect Pests*

#### *Effect on the Larval Population of Cabbage*

**Table 1.** Overall effect of intercropping on the incidence of *P. xyloistella, P. brassicae* and *B. brassica*e. Figures in parentheses are $\sqrt{X+0.5}$ transformed values. [1]Means of seven observations recorded at 2nd, 3rd, 4th, 5th, 6th, 7th and 8th week after transplanting. [2]Mean cabbage yield based on three replications.

| Treatment | C + I Ratio | [1]Mean population of insect per plant *P. brassicae* | *P. xylostella* | *B. brassicae* | [2]Cabbage yield (t/ha) |
|---|---|---|---|---|---|
| Cabbage + onion | 1 : 2 | 5.97 (2.23) | 9.39 (2.76) | 60.77 (7.70) | 14.16 |
| Cabbage + garlic | 1 : 2 | 4.59 (2.20) | 5.72 (2.25) | 52.71 (7.13) | 15.35 |
| Cabbage + marigold | 1 : 1 | 4.02 (1.94) | 4.20 (1.98) | 50.70 (6.96) | 17.30 |
| Cabbage + broad bean | 1 : 1 | 8.23 (2.80) | 9.87 (2.89) | 63.4 (7.79) | 13.95 |
| Cabbage + potato | 1 : 1 | 6.74 (2.38) | 9.27 (2.72) | 63.14 (7.80) | 14.58 |
| Cabbage + tomato | 1 : 1 | 5.97 (2.44) | 7.46 (2.49) | 57.06 (7.43) | 16.70 |
| Cabbage sole | – | 11.24 (3.16) | 9.92 (2.89) | 71.47 (8.36) | 13.45 |
| SE (±) | – | 0.41 | 0.10 | 0.16 | 0.42 |
| CD (*P*=0.05) | – | 0.83 | 0.38 | 0.32 | 0.83 |

*Butterfly.* The results based on three sprays pooled mean data on field evaluation of six cow-urine indigenous plant extracts, three commercial plant based insecticides and one conventional insecticide against CB revealed that dichlorvos at 500 g. a. i. / ha proved to be the most effective with mean larval population of 1.11/plant compared to 2.65 to 7.23/plant in the phyto-products and 11.40/plant in untreated check (Table 3). The second effective insecticides were calpaste at 1550 g/ha and *Melia azedarach* at 12, 500 ml/ha with their corresponding mean larval population of 2.65 and 3.84/plant, respectively, but calpaste showed insignificant difference with dichlorvos and were considered these two insecticides equally effective against the moth. The extracts of *Vitex trifolia* and *Artemisia nilagirica* each applied at 12, 500 ml/ha having 7.23 and 5.44 larvae/plant, respectively also did not show satisfactory control of the pest.

*Effect on the Larval Population of Diamond Back Moth.* Against DBM, dichlorvos at the same dose was also found to be the most effective in suppressing the insect, recording the minimum mean population of 4.16 larvae/plant compared to 7.25 to 10.37 larvae/plant in rest of the insecticidal treatments

**Table 2.** Economics of cabbage and intercrops in the experimental crop during *rabi* of 2004-05. C=Cabbage ; I= Intercrop. Cabbage at Rs 3.00/kg ; Onion Rs 12.00/kg ; Garlic Rs 15.00/kg ; Marigold Rs 15.00/kg ; Broad bean Rs 20.00/kg ; Potato Rs 10.00/kg ; Tomato Rs 20.00/kg.

| Treatment | C + I Ratio | Mean yield of cabbage (t/ha) | Return from cabbage (Rs/ha) | Mean yield of intercrops (t/ha) | Return from intercrops (Rs/ha) | Gross return (Rs/ha) | Additional return over cabbage sole crop (Rs/ha) |
|---|---|---|---|---|---|---|---|
| Cabbage + onion | 1 : 2 | 14.16 | 42,480.00 | 1.85 | 22, 200.00 | 64,680.00 | 24,330 |
| Cabbage + garlic | 1 : 2 | 15.35 | 46,050.00 | 1.50 | 22,500.00 | 68,550.00 | 28,200 |
| Cabbage + marigold | 1 : 1 | 17.30 | 51,900.00 | 2.85 | 42,750.00 | 94,650.00 | 54,300 |
| Cabbage + broad bean | 1 : 1 | 13.95 | 41, 850.00 | 8.95 | 19,000.00 | 60,850.00 | 20, 500 |
| Cabbage + potato | 1 : 1 | 14.58 | 43,740.00 | 3.56 | 35,600.00 | 79,340.00 | 38,990 |
| Cabbago + tomato | 1 : 1 | 16.70 | 50,100.00 | 1.99 | 38,800.00 | 89,900.00 | 49,550 |
| Cabbage sole | – | 13.45 | 40,350.00 | – | – | 40,350.00 | – |

**Table 3.** Relative effect of insecticides on the population of pests and yield of cabbage during *rabi* of 2004-05. Figures in parenthese are $\sqrt{X + 0.5}$ transformed values. [1] Mean larval/aphid population of six time intervals under observations based on three applications data. [2] Mean cabbage yield (t/ha) based on three replications.

| Treatment | Dose (ml/ha) | [1]Mean population of insects/plant *P. xylostella* | *P. brassicae* | *B. brassicae* | [2] Cabbage yield (t/ha) |
|---|---|---|---|---|---|
| *Melia azedarach* | 12,500 | 3.84 (1.85) | 9.58 (2.58) | 27.11 (5.23) | 21.21 |
| *Jatropha gossypfoilia* | 12,500 | 4.10 (1.98) | 7.25 (2.62) | 26.80 (5.20) | 19.60 |
| *Lantana canara* | 12,500 | 4.86 (2.31) | 9.71 (2.87) | 28.47 (5.40) | 18.11 |
| *Acorus calamus* | 12,500 | 5.27 (2.22) | 10.37 (2.92) | 30.60 (5.56) | 17.71 |
| *Artemisia nilagirica* | 12,500 | 5.44 (2.32) | 9.80 (2.96) | 30.15 (5.51) | 17.84 |
| *Vitex trifolia* | | 7.23 (2.61) | 10.20 (3.04) | 32.56 (5.73) | 17.63 |
| Calpaste | 1,500g/ha | 2.65 (1.58) | 9.32 (2.90) | 27.35 (5.26) | 22.76 |
| Cal-10 | 1,000 | 3.50 (1.84) | 8.96 (2.79) | 28.80 (5.40) | 21.95 |
| Cal-MB | 1,000 | 4.46 (1.96) | 7.79 (2.63) | 26.64 (5.20) | 20.11 |
| Dichlorvos 76WSC | 500 g a.i./ha | 1.11 (1.15) | 4.16 (1,99) | 11.64 (3.42) | 23.51 |
| Control | – | 11.40 (3.29) | 19.71 (4.14) | 40.23 (6.37) | 13.95 |
| SE ± | – | 0.22 | 0.35 | 0.15 | 0.43 |
| CD = (*P*= 0.05) | – | 0.46 | 0.71 | 0.30 | 0.90 |

and 11.40 larvae/plant in untreated check. The effectiveness of dichlorvos was closely followed by *J. gossypifolia* at 12,500 ml/ha and Cal-MB at 1,000 ml/ha registering 7.25 and 7.79 larvae/plant, respectively, but differed significanty from each other. *Acorus calamus* with mean larval population of 10.37/plant was least effective against the butterfly. However, all the insecticidal treatments were significantly superior to untreated check in minimizing the pest population (Table 3).

*Effect on the Population of Cabbage Aphid.* The mean aphid population indicated that all the insecticides evaluted were significantly effective against the aphid as compared to the untreated control (Table 3). Mean aphid population varied from 11.64 to 32.56/plant in the insecticidal treatments compared to 40.03/plant in untreated control. The plots treated with dichlorvos also resulted in the lowest population of the aphid. The effectiveness of Cal-MB (26.64 aphids/plant), *J. gossypifolia* (26.80 aphids/plant), *M. azedarach* (27.11 aphids/plant), calpaste (27.35 aphids/plant). *Lantana camara* (28.47 aphids/plant) and Cal-10 (28.80 aphids/plant ) against cabbage aphid had non-significant difference from one another. The treatment with *V. trifolia* also showed its inferiority over rest of the test compounds during the post-application period with a record of maximum aphid population. The present findings are partially accordance with the report of Pandey et al. (6) who observed the extracts of *J. gossypifolia*, *M. azedarach* and *Ageratum conyzoides* as most effective against *Lipaphis erysimi* (Kalt.).

A closer examination of the results of cow-urine indigenous plant extracts included in the field evaluation revealed that all the six extracts each applied at 12,500 ml/ha were significantly effective in reducing the population of CB, DBM and CA on cabbage as compared to untreated control. However, among the extracts minimum mean population of all the three pests was recorded in *J. gossypifolia* treated plots followed by *M. azedarach, L. camara*, *Artemisia nilagirica* and *A. calamus* plots which showed insig-

**Table 4.** Avoidable loss of cabbage due to *P. brassicae, P. xylostella*, and *B. brassicae* and increase yield of different insecticidal treatments over control during *rabi* of 2004-05. Dichlorvos at 500 g a.i./ha recorded the highest cabbage yield at 23.51 t/ha on the basis of which avoidable losses in different insectticidal treatments have been determined.

| Treatment | Dose (ml/ha) | Yield (t/ha) | Avoidable loss (%) | Increase cabbage yield over control | |
|---|---|---|---|---|---|
| | | | | t/ha | Percentage |
| *Melia azedarach* | 12,500 | 21.21 | 9.78 | 7.26 | 52.04 |
| *Jatropha gossypfoilia* | 12,500 | 19.60 | 16.63 | 5.65 | 40.50 |
| *Lantana canara* | 12,500 | 18.11 | 22.97 | 4.16 | 29.82 |
| *Acorus calamus* | 12,500 | 17.71 | 24.67 | 3.76 | 26.95 |
| *Artemisia nilagirica* | 12,500 | 17.84 | 24.12 | 3.89 | 27.89 |
| *Vitex trifolia* | | 17.63 | 25.01 | 3.68 | 26.38 |
| Calpaste | 1,500 | 22.76 | 3.19 | 8.81 | 63.15 |
| Cal-10 | 1,000 | 21.95 | 6.64 | 8.00 | 57.35 |
| Cal-MB | 1,000 | 20.11 | 14.46 | 6.16 | 44.16 |
| Dichlorvos 76 WSC | 250 | 23.51 | 0.00 | 9.56 | 68.53 |
| Control | – | 13.95 | 40.66 | – | – |

nificant difference between them. The treatments with *V. trifolia* and *A. calamus* were proved to be inferiority to other extracts in the control of moth, butterfly and aphid (Table 3). The present results on moderately effective of *J. gossypifolia* and *M. azedarach* extracts against *P. brassicae* and *P. xylostella* are in conformity with these of Singh and Khuman (7).

*Effect on the Cabbage Yield.* The highest yield (23.51 t/ha) was harvested from dichlorvos treated plots followed by the pots treated with calpaste (22.76 t/ha), Cal-10 (21.95 t/ha), *M. azedarach* (21.21 t/ha), Cal-MB (20.11 t/ha) and *J. gossypifolia* (19.60 t/ha) as compared to 17.63 to 18.11 t/ha in the rest of the five insecticidal treatments and 13.95 t/ha in untreated control. The cabbage yields recorded in all the insecticidal treatments were significantly higher than that of untreated control (Table 3).

The avoidable loss due to CB, DBM and CA infestation varied from nil in dichlorvos sprayed plots at 500 g a. i. /ha to 40.66% in untreated check. Among the plots treated with insecticides maximum avoidable loss (25.01% ) was computed in the plots treated with *V. trifolia* extracts at 12500 ml/ha (Table 4).

The significant findings generated from the present field investigation lead to conclusion that intercropping of cabbage with marigold/garlic/tomato followed by spraying of phyto-products like *M. azedarach* / *J. gossypifolia* / calpaste may be incorporated as effective components in developing an IPM module for *P. brassicae, P. xylostella*, and *B. brassicae* management under cabbage crop-ecosystem of Manipur valley.

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