

# PHYTO-SOCIOLOGICAL EFFECT OF DAIRY EFFLUENT ON WEED FLORA IN ASSOCIATION WITH MUSTARD CROP (*BRASSICA JUNCEA* L. CZERN & COSS.)

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**Abstract:** Samples of dairy effluent were collected from Parag milk plant Partapur, Meerut. Three concentrations (25, 50 and 100%) were used in this experiment. Tap water served as control. Effect of dairy effluent was studied on weeds in association with Indian mustard cvs. Pusa Bold, Pro Agro 4001 and T-59, which is grown as oil crop in India and abroad. The effluent effect with different concentrations has been assessed in all the cultivars of *B. juncea*. It was observed that weed frequency was higher significant in cultivar T-59 whereas, Pusa Bold greatly reduced it. Phyto-sociological dominance of *Cannabis sativa* L. and co-dominance of *Chenopodium album* L. in crop have also been recorded.

**Keywords :** Allelopathic effect, *Brassica juncea*, *Cannabis sativa*, *Chenopodium album*, dairy effluent, Meerut, weed density, weed frequency

## INTRODUCTION

Surface water pollution caused irreparable damaged to plants, animals, soil and human beings. Maximum water pollution is found in the sea than rivers due to leakage and accident in oil carrier ships in the sea and near the sea bank. The reuse of polluted surface water as such for irrigating the agricultural fields severely damages crops, decreases grain yield production and increased endangered species. Polluted water is also responsible for high incidence of typhoid, jaundice, hepatitis, dysentery, diarrhoea, Tuberculosis, Intestinal infection and spreading epidemics and chronic disease in men. It enhanced breeding places of mosquitoes but decrease milk production and breeding capacity in cattle (Ali Khan, 1996). Recently, World Health Organization (WHO) reported that 21% of all communicable water born disease killed more than 3 million peoples and caused 9 hundred million cases of illness in the world. As many as 76 million peoples mostly children could be die from water born disease such as cholera, hepatitis, dysentery and cancer by 2020, if changes are not made worldwide (Valles, 2002).

Dairy industry is one of the leading industries in India, producing milk and its related products which generating high amounts of effluents (Ajmal *et al.*, 1984). The first modern dairy was started in 1987 by a Swedish dairy expert Mr. Edward Keventer, near a village Chherat at Aligarh in western U.P. (Agarwal, 1988). Gangol Sehkari Dugd Utpadak Sangh Ltd. Partapur, Meerut is one of the 10<sup>th</sup> modern dairy industries (Pasteurization plant) of western U.P., which is located geographically 29° north and 77° 40' east and situated at 60 km north-east of Delhi. Parag dairy generates 2000 to 3000 liters waste water after pasteurization of milk, cream, butter, milk cake and cheese powder etc. The dairy waste water contains caustic soda, amyl alcohol, nitric acid and sulphuric acid with high BOD and acidic pH (6.5) but contains fat 20%, proteins 0.15% and 109 mg/l lactose (Rodionova *et al.*, 1989 and Fang, 1990). Sulphur,

organic matter and minerals present in dairy waste water may be beneficial to oil yielding mustard crop.

Mustard is a major oil seed rabi crop out of seven edible oil seeds viz., ground nut, sunflower, safflower, rapeseed, soybean, sesame and niger. Thus oil seed crops occupy a unique position in our farming system with an impressive next to food grains. Mustard is the second oil seed crop next to ground nut. To accelerate production of oil seed a National Oil Seed Development Research Project was started in 1986 by National Research centre for Rapeseed and Mustard at Bharatpur in Rajasthan. *Brassica juncea* is an allopolyploid of *B. campestris* (2n=20 chromosomes) and *B. nigra* (2n=16 chromosomes). *B. juncea* originated in China and from there it was introduced to India then Afghanistan (Bailey, 1922). It is an important oil yielding crop of Meerut (U.P.) and a good source of fodder and mustard cake as well. Mustard cake is used to enhance milk production in buffalo and cow. Mustard leaves are consumed as "saag" and also used for culinary purposes by humans. The oil is used as an article of diet as a substitute of lard or ghee and for lightening the houses at Deepawali in India. The seeds or flour act as a digestive condiment if taken moderately. Canada and China are still harvesting 60% higher yield of mustard than India (Meena *et al.*, 1996).

There are several reasons of low seed yield of mustard in our country, among these weed infestation is one of the major causes for yield reduction in crops. Weeds are obnoxious plants of the cultivated lands where they are not desired to grow by the farmers. They compete for water, space and light with crop plants and reduce vigour and yield. They divert the path of energy from the direction desired by man. An alternative for overcoming these problems is to use allelopathic strategies in weed management for sustainable agriculture (Narwal *et al.*, 1997). Allelopathy has been considered as the suppressive effect on the growth of some plants through chemicals released

from other plants (Rice, 1974). The genus *Brassica* is rich in sulphur containing compound glucosinolates which are responsible for the allelopathic activity (Abdulla, 2007).

Present investigation has aroused the interest because no efforts have been made to study on environmental pollution caused by Parag dairy effluent Partapur, Meerut. Mustard crop has been taken for study, which may be helpful in "Yellow revolution" strategy for sustainable agriculture and environmental management because systematic disposal of dairy effluent acts as "liquid fertilizer" into cultivable land. Therefore, keeping above facts in view, present study was designed to evaluate the risk assessment of dairy effluent on environmental management for agro-ecological effects on crop and weed flora.

## MATERIAL AND METHOD

The present investigation has been conducted to observe the phyto-sociological effect of dairy effluent of Gangol Sehkari Dugdh Utpadak Sangh limited (Parag) Partapur, Meerut and its effect on weed flora in association with mustard crop. The experiment was conducted in college campus with three cultivars of *Brassica juncea* L. Czern & Coss. viz., Pusa Bold, Pro Agro 4001 and T-59. The untreated samples of dairy effluent were collected from the main drain of industry before entering into the Effluent Treatment Plant (E.T.P.). The treated samples of dairy effluent were collected from outlet of the aeration tank, where biological treatment was given.

**Experimental Design:** Sterilized and dried seeds of all the cvs. of *B. juncea* were sown in sandy loam soil during winter season at the college agricultural research farm. The experiment was conducted in randomized block design (RBD) with three replications. Growth parameters were recorded at 30, 45, 60, 75, 90 and 105 days after sowing (DAS).

**Weed Study:** The study of weeds was made by laying quadrats of 0.25 m<sup>2</sup> randomly at four places in each plot. The data were expressed in per m<sup>2</sup>. Their frequency and density were recorded by following formulae-

Frequency (%) =

$$\frac{\text{No. of quadrats in which the species occurred}}{\text{Total no. of quadrats studied}} \times 100$$

$$\text{Density (D)} = \frac{\text{Total no. of individuals of a species}}{\text{Total no. of quadrats studied}}$$

## RESULT AND DISCUSSION

**Effect on weed flora:** The mustard crop is of about 135 days duration. The crop was sown in the first week of November. There was no weedicide used in field condition. As many as ten weed species viz.,

*Anagallis arvensis* L., *Cannabis sativa* L., *Chenopodium album* L., *Cynodon dactylon* L., *Cyperus rotundus* L., *Fumaria indica* L., *Lathyrus odoratus* L., *Nepeta hindustana* L., *Spergula arvensis* L. and *Stellaria media* L. have been observed in association with the crop. The frequency and density of these weeds have been recorded.

**Frequency of weeds:** There was no inhibitory effect in frequency of weeds (*Anagallis arvensis*, *Chenopodium album*, *Cynodon dactylon*, *Cyperus rotundus*, *Fumaria indica* and *Spergula arvensis*) at 25% concentration of treated effluent in cvs. Pro Agro 4001 and T-59 whereas, very mild effect was observed in cv. Pusa Bold (Table 1). Maximum inhibitory effect was observed in weeds frequency at 100% concentration of treated effluent in all the cultivars. Similar trends were observed at different concentrations of untreated effluent but it has been recorded that untreated effluent has more inhibitory effect than treated effluent in all the cultivars. It was also observed that all the cultivars of *B. juncea* influenced the weeds frequency in untreated effluent but maximum allelopathic effect was found in *Nepeta hindustana*.

**Density of weeds:** Interrelationship of weed density has been recorded. A perusal observations show that the mustard crop faces maximum competition with monocot weed (*Cyperus rotundus*) while among the eight dicot weeds only *Stellaria media* offering competition. Phyto-sociological dominance (*Cannabis sativa*) and co-dominance (*Chenopodium album*) of weeds in the crop have also been recorded. It was observed that maximum weed density was found in cv. T-59 as compared to cvs. Pusa Bold and Pro Agro 4001 in all the concentrations of both treatments however, 25% concentration of the treated effluent was most stimulatory in all the cultivars (Table 2).

The effect of effluent on crop-weed relationship revealed that as many as ten species of weeds occurred within the crop. In all these weeds which are growing along field boundaries cause very little damage in comparison of growing within the mustard crop. *Cynodon dactylon* is fastly growing harmful monocot weed because it reproduces vegetatively as well as sexually. It not only creeps on the soil surface but also competes with crop plants for physiological processes. Allelopathic effect of *Parthenium hysterophorus* L. weed assessed on dry matter production and productivity of *Phaseolus aureus* L. var. T-44 and *Triticum aestivum* L. var. 4C262 (Chhavi and Anand, 1989). Al-Khatib and Boydston (1999) reported that *Brassica* species suppress the weeds through (a) release of allelochemicals into soil from the roots of living plants (b) leaching/secretion of glucosinolates into the growing media, their hydrolysis to isothiocyanates inhibits weed seed germination and growth. Goel and Mandavekar (1983) concluded that 10% diluted distillery effluent can be effectively used for *Cyamopsis tetragonoloba*.

Phyto-sociological studies revealed that dominance (*Cannabis sativa*) and co-dominance of (*Chenopodium album*) weeds in the crop have been recorded in all the three cvs. of *B. juncea*. Similar reports have also been observed in sugarcane field

(Sharma *et al.*, 1973). However, weeds were significantly higher in 25% concentration of treated effluent in all the cultivars because lower concentration of treated effluent acts as liquid fertilizer for crop as well as weeds.

**Table 1.** Effect of Parag dairy effluent on weed frequency (%) in different cultivars of *Brassica juncea* L. Czern & Coss.

Name of Weed species	Family	cv. Pusa Bold									cv. Pro Agro 4001									cv. T-59								
		Control	Untreated effluent Concentrations			Treated effluent Concentrations			Control	Untreated effluent Concentrations			Treated effluent Concentrations			Control	Untreated effluent Concentrations			Treated effluent Concentrations								
			25 %	50 %	100 %	25 %	50 %	100 %		25 %	50 %	100 %	25 %	50 %	100 %		25 %	50 %	100 %	25 %	50 %	100 %						
<i>Anagallis arvensis</i> L.	Primulaceae	80	90	60	40	90	70	50	90	100	70	50	100	80	60	100	100	80	60	100	90	70						
<i>Cannabis sativa</i> L.	Cannabinaceae	60	70	40	30	80	50	40	70	80	50	40	90	60	50	80	90	60	50	100	70	60						
<i>Chenopodium album</i> L.	Chenopodiaceae	70	80	50	30	90	60	40	80	90	60	40	100	70	50	90	100	70	50	100	80	60						
<i>Cynodon dactylon</i> L.	Poaceae (Gramineae)	80	90	70	50	90	80	60	90	100	80	60	100	90	70	100	100	90	70	100	90	80						
<i>Cyperus rotundus</i> L.	Cyperaceae	70	90	60	30	90	70	50	80	100	70	40	100	80	60	90	100	80	50	100	90	70						
<i>Fumaria indica</i> L.	Fumariaceae	70	80	60	40	90	70	50	80	90	70	50	100	80	60	90	100	80	60	100	90	70						
<i>Lathyrus odoratus</i> L.	Papilionaceae	50	60	40	30	70	50	40	60	70	50	40	80	60	50	70	80	60	50	90	70	60						
<i>Nepeta hindustana</i> L.	Labiatae (Lamiaceae)	20	30	10	10	40	30	20	30	40	20	20	50	40	30	40	50	30	30	60	50	80						
<i>Spergularia arvensis</i> L.	Caryophyllaceae	80	90	60	50	90	70	60	90	100	70	50	100	80	70	100	100	80	60	100	90	80						
<i>Stellaria media</i> L.	Caryophyllaceae	60	70	50	40	80	60	50	70	80	60	50	90	70	60	80	90	70	60	90	80	70						

**Table 2.** Effect of Parag dairy effluent on weed density in different cultivars of *Brassica juncea* L. Czern & Coss.

Name of Weed species	Family	cv. Pusa Bold									cv. Pro Agro 4001									cv. T-59								
		Control	Untreated effluent Concentrations			Treated effluent Concentrations			Control	Untreated effluent Concentrations			Treated effluent Concentrations			Control	Untreated effluent Concentrations			Treated effluent Concentrations								
			25 %	50 %	100 %	25 %	50 %	100 %		25 %	50 %	100 %	25 %	50 %	100 %		25 %	50 %	100 %	25 %	50 %	100 %						
<i>Anagallis arvensis</i> L.	Primulaceae	3.2	3.6	3.0	1.5	3.8	3.1	1.8	3.4	3.8	3.2	1.7	4.0	3.3	2.0	3.5	3.9	3.3	1.8	4.1	3.8	2.1						
<i>Cannabis sativa</i> L.	Cannabinaceae	2.0	2.2	1.5	1.2	2.4	1.7	1.4	2.2	2.4	1.7	1.4	2.6	1.9	1.6	2.3	2.5	1.8	1.5	2.7	2.0	1.7						
<i>Chenopodium album</i> L.	Chenopodiaceae	2.2	2.4	2.0	1.5	2.6	2.2	2.0	2.4	2.6	2.2	1.7	2.8	2.4	2.2	5.6	2.7	2.3	1.8	2.9	2.5	2.3						
<i>Cynodon dactylon</i> L.	Poaceae (Gramineae)	3.2	3.8	2.0	1.3	4.0	2.2	1.7	3.4	4.0	2.2	1.5	4.2	2.2	1.9	3.5	4.1	2.3	1.6	4.3	2.5	2.4						
<i>Cyperus rotundus</i> L.	Cyperaceae	4.9	5.7	4.8	4.2	6.0	4.2	4.4	5.1	5.9	4.2	4.4	6.2	4.4	4.6	5.2	6.0	4.3	4.5	6.3	4.5	4.3						

<i>Fumaria indica</i> L.	Fumariaceae	4.0	4.8	3.8	2.8	8.8	3.8	3.0	4.2	5.0	4.0	3.0	6.0	4.0	3.1	4.3	5.1	4.1	3.4	6.1	4.1	3.2
<i>Lathyrus odoratus</i> L.	Papilionaceae	3.0	2.7	2.0	1.7	2.8	2.2	2.0	3.2	3.7	2.2	1.9	3.8	2.4	2.2	3.3	3.8	3.3	2.0	3.9	2.5	2.3
<i>Nepeta hindustana</i> L.	Labiatae (Lamiaceae)	0.8	0.9	0.3	0.1	1.0	0.4	0.3	1.0	1.1	0.5	0.3	1.2	0.7	0.5	1.1	1.2	0.6	0.4	1.3	0.8	0.6
<i>Spergula arvensis</i> L.	Caryophyllaceae	1.1	1.2	0.9	0.7	1.3	1.1	0.8	1.3	1.4	1.1	0.9	1.5	1.3	1.0	1.4	1.5	1.2	1.0	1.6	1.4	1.4
<i>Stellaria media</i> L.	Caryophyllaceae	4.8	4.6	4.0	2.9	5.5	4.1	3.1	5.0	5.8	4.1	2.2	6.1	4.3	3.2	5.1	5.9	4.2	3.3	6.2	4.4	3.4

## CONCLUSION

Allelopathic effect of *Brassica* species has been assessed. It was observed that the frequency of weeds was more significant in cv. T-59 whereas, Pusa Bold significantly reduced it. Phyto-sociological dominance of *Cannabis sativa* and co-dominance of *Chenopodium album* in crop have been recorded. It has been recorded that maximum yield production was found in cv. Pusa Bold as compared to Pro Agro 4001 and T-59.

## Recommendation

Research findings recommended that effluent should be properly treated before its disposal into available land then it could be used as “liquid manure”, which is one of the best practical methods for the disposal of dairy effluent to eliminate pollution problems for “evergreen revolution”. Therefore, effluent treatment plant (E.T.P.) should be installed in each pasteurization plant like distilleries to check water pollution so that water bodies like holy Ganga can be saved from deterioration. Further, it will not only arrange marriage between environment and economy but would have also cascading effect on national economy to curb price inflation of fertilizer. Moreover, it will be a tool to handle “Chemical Time Bomb” in soil and sediment in world scenarios.

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