

# Nursery Management of Cauliflower and Cabbage for Damping off in Rainy Season

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## ABSTRACT

Experiments on nursery management of cauliflower and cabbage were conducted with the purpose to find out the best and practicable control measures against damping off. The experiments were conducted in two consecutive years viz 2000 and 2001 at North farm of ARS, Pakhribas (2000 m) and Sindhuwa (2200 m) of Dhankuta district. The design was RCB with 2 x 5 factorial arrangements. The factor soil composition has two levels soil + compost and soil + sand + compost. While second factor soil treatment has five levels namely formalin drenching, solarization, burning, agronomic soil and control. 2.5 % formalin solution 4 lit/m<sup>2</sup> drenched for moisten 4 inch soil before 21 days of seed sowing drenched. After soil drenching plots were covered with plastic sheet for seven days. After seven days plastic sheets were removed and plots were left for 14 days by turning soil. For soil burning method 2.5 inch slow burning materials like rice husk, saw dust used for soil burning before seed sowing. Highest percentage of cauliflower marketable seedlings (90.29) obtained from soil burning followed by formalin drenching (90.05). While untreated (control) plot produced 80.67% of marketable seedlings. In case of severity of damping off lowest percentage was recorded from soil burning (7.19) followed by formalin drenching (7.68). the combination of sand in soil and compost mixture did not show any remarkable difference to control damping off in cauliflower. Similarly highest percentage of cabbage seedlings were recorded from formalin drenching (90.81) followed by soil burning (87.47). The combination of soil + sand + compost was found better to produce highest percentage of marketable cabbage seedlings (87.55) than only soil + compost (84.56). Formalin drenching produced lowest percentage of damping off (6.36). Similarly addition of sand in nursery bed was found better producing lowest (10.07) percentage of damping off as compared to only soil and compost. Overall considering all parameters the soil treatment with formalin and soil burning with combination of sand in soil + compost were found superior to control damping off and produce highest number of seedlings.

## INTRODUCTION

Cauliflower and cabbage are the most important commercial vegetables in Nepal (NPC, 1995). We already have the year round cultivation technology of cabbage. Cauliflower also can be produced 10 month easily. The exploitation of new heat tolerant varieties it's year round cultivation also possible. A study on average market price at Kalimati shows that the price of cauliflower is highest in Aswin (Rs. 35/kg) and lowest in Baisakh (Rs. 12/kg). Likewise, the market price of cabbage is highest in Kartik (Rs. 16/kg) and lowest in Chaitra (Rs. 2.60/kg)(Monthly Kalimati Market Situation 2055-2056). This data indicate that the market price of cauliflower and cabbage goes peak (three to eight times more) in the duration of Aswin and Kartik. Farmers are focusing in cauliflower and cabbage production due to its high monetary value. That's why cauliflower (19267 ha) and cabbage

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(15514 ha) are number one and two vegetable of Nepal in area of production (Shrestha and Ghimire, 1996).

There are already many studies had been carried out about varieties of cauliflower and cabbage. It resulted that some heat tolerant and moisture tolerant varieties which can be cultivated in off-season. But there are very few works have been done about nursery and cultivation practices. Damping off is the most serious problem for cauliflower and cabbage nursery. This disease is reported as main problem in many reports. This disease is most serious during rainy season. Katyal (1977) quoted that damp, warm and cloudy weather and high soil moisture encourages damping off disease. The period during April to August is the hottest time of the year and most of the rainfall is concentrated from May to September in the hills (Gurung and KC, 1993). According to farmers in survey, sometimes whole bed collapse due to damping off disease. Some experiments have been conducted in Pakhribas and Lumle. Pakhribas had recommended brassicol 1% solution is the best for damping off control (Gautam et al., 1990). While Lumle had recommended formalin drenching before seed sowing control the damping off (Ghimire, 1994). In spite of these recommendations, farmers of Nepal still are suffering from damping off disease, while even a single hybrid seed costs around 3.6 paisa. It may be due to unavailability of these chemicals in local market. The next reason may be lengthy process of formalin application. The objective of this research is to identify the best management practice, which minimizes the damping off problem during rainy season production of cauliflower and cabbage.

## **MATERIALS AND METHODS**

The experiments were conducted at Pakhribas (North farm) and Sindhuwa of cauliflower and cabbage respectively for two consecutive years viz. 2000/2001 and 2001/2002. The altitude of North Farm of ARS, Pakhribas was 2000 m and Sindhuwa was 2200 m. The design was RCB with 2x5 factorial arrangements, which replicate three times. The factor A (Soil composition) has two levels i.e. soil + compost and Soil + sand + compost. While second factor B (Soil treatment) has five levels like formalin drenching, soil solarization, soil burning, agronomic soil and control.

The plot sizes of nurseries were 0.5 m x 0.5 m. 1: 40 formalin (Formaldehyde) drenched to 6 plots at the rate of 25ml/lit and 2 liter solution used in 0.25 m<sup>2</sup> plot for 4 inch soil moisturize. After drenching the plots were covered with plastic sheet and left for seven days. After seven days plastic sheets were removed to expose the soil for fourteen days. For the soil solarization, the plots were covered by plastic sheet for fifteen days. For the burning treatment 2.5 inch thick saw dust and rice husk as a slow burning material were used to sterilize the nursery bed before seed sowing. In agronomic soil plot the soil from agronomic field were used as nursery soil. 250 seeds per plot were sown at the spacing of 10 cm row to row and 1 cm seed to seed. Cauliflower seeds were sown in 4<sup>th</sup> June 2000 and 13 May 2001. While cabbage seeds were sown 21 May 2000 and 13 May 2001.

The varieties used for this trial were Snow Crown of cauliflower and Green Coronet of cabbage. High shed of plastic was constructed to protect the seedlings from high rainfall. Rice straw was used as mulching material. The control plot was left without any soil treatment.

After seed emergence seedlings were counted in every alternate day and observations on number of seedling, heights of seedling, seedlings dead from damping off and other causes as cutworm were recorded.

## **RESULTS AND DISCUSSION**

### **Total marketable seedlings of cauliflower and cabbage**

The data analysis of marketable seedlings of cauliflower over two years showed that soil treatments and interaction of soil composition and soil treatments over years are significantly different (Table 2). Among the soil treatments formalin drenching, solarization, burning, agronomic soil all treatments are better than control. Within four soil treatments soil burning produce highest (90.29%) marketable seedlings and followed by formalin drenching treatment (90.05%) (Table1). Soil solarization was not found statistically superior over control plots of nursery plots did not. This may be due to very low intensity of sunlight during nursery raising period at Pakhribas. The average sunshine hour of Pakhribas during experiment was two hours. Similarly soil from agronomic field show any significant result among other soil treatment methods. Solarization, agronomic soil and control plots produced marketable seedlings at par with 83.93, 83.81 and 80.67 percentages respectively (Fig.1). The sand mixture in nursery plot did not show any remarkable difference in total marketable seedlings.

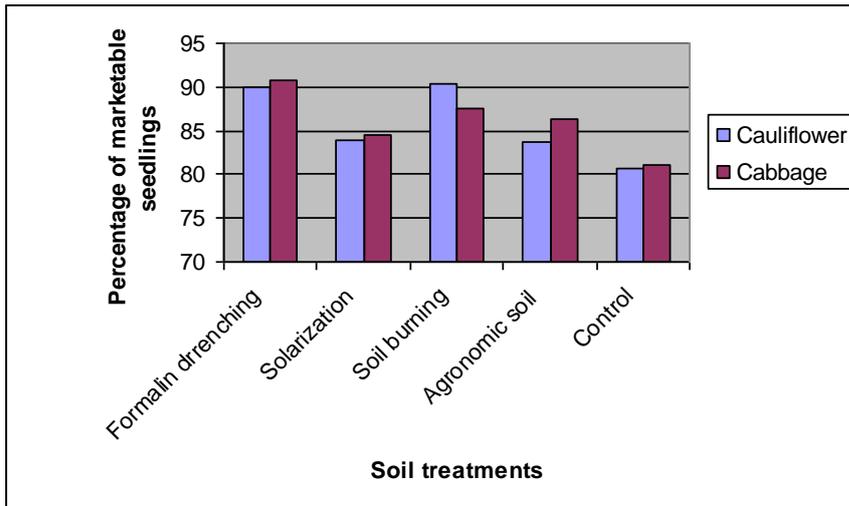
Same trend of result observed in cabbage as like cauliflower (Fig.1). Among the soil treatments formalin drenching had produced highest (90.81) percentage of marketable seedlings. This treatment was found superior over all of other treatments. Another treatment soil burning also found effective to give second highest (87.47) percentage of marketable seedlings. Soil burning treatment was found statistically better than solarization and control plots, while found at par with agronomic soil. Similarly agronomic soil and solarization plots were also found statistically at par with 86.34% and 84.53% respectively (Table 3). All the treated plots were found better as comparison to untreated plot.

Soil combination also found highly significant different to produce total percentage of marketable cabbage seedlings (Table 4). The combination of soil, sand and compost has resulted maximum percentage of marketable seedlings (87.55). While only soil and compost mixture resulted 84.56% seedlings. The increment of soil porosity by adding sand is the probable reason of it.

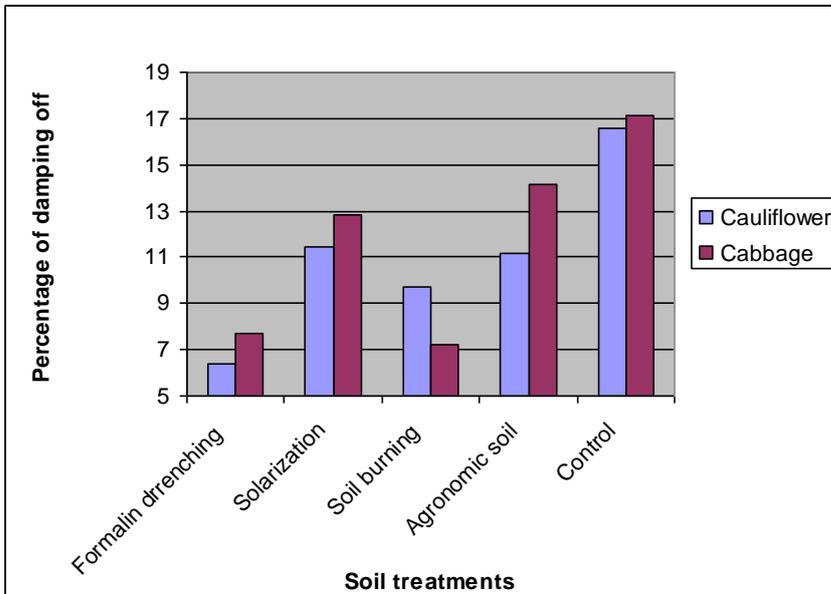
### **Severity of damping off disease on cauliflower and cabbage**

The dead seedlings of cauliflower were counted in every alternate day till field transplantation. The cauliflower seedlings death due to damping off were analyzed and highest (17.10 %) seedlings were dead in control plot (Fig.2). While lowest (7.19 %) were found death in burning plot that followed by formalin drenching plot (7.68 %) (Table1). The soil and sand composition also not significant in damping off control. In the year 2000/2001 the more seedlings were dead from damping off than year 1999/2000 which maybe due to high incidence of damping of in year 2000/2001.

The data analysis of dead seedlings of cabbage from damping off resulted that less seedlings were dead from damping off disease where sand was mixed in the nursery plots (Fig.2). Among the different soil treatments formalin drenching (6.36 %) and soil burning (9.70 %) were found better to control damping off (Table 3). While solarization and agronomic soil produced similar results with 11.46 and 11.16 percentage damping of. The soil and sand mixture of nursery plots produced significantly minimum percentage of damping off pathogens. High soil moisture favors the damping off pathogens. Addition of sand in nursery soil will increase the soil porosity and drain the excess moisture. The damping off incidence was observed high in the year 2000/2001.



**Figure 1.** Effect of soil treatments on total marketable seedlings of cauliflower and cabbage.



**Figure 3.** Effect of soil treatments on damping off control of cauliflower and cabbage.

### **Total seedlings of cauliflower and cabbage damaged by cutworm**

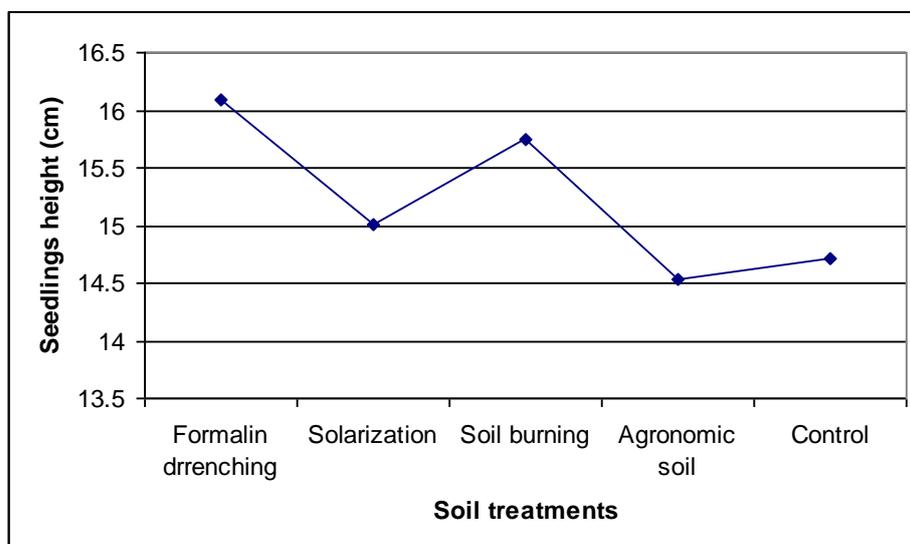
The infestation of cutworm on cauliflower seedlings was high in the year 1999/2000 than in the year 2000/2001. Soil composition and soil treatments were not differ significantly. In an average 2.5% seedlings dead in all plots due to cutworm.

Cabbage seedlings dead from cutworm were found significant different only in years. Fewer seedlings were found dead from cutworm in year 1999/2000 (Table 3). Rest of all soil treatments and compositions were found non significant.

### **Seedling height of cauliflower**

Plant height of cauliflower seedlings were recorded in a week interval until field transplantation of seedlings. The data analysis indicated that soil treatments and year are

statistically different. The highest seedlings height was recorded in formalin drenching plot (16.09 cm) and then in burning plot (15.74 cm).



**Figure 4.** Effect of soil treatments on seedlings height of cauliflower.

**Table 1.** Effect of different soil treatments and soil composition on marketable seedlings and damping off severity of cauliflower.

Soil comp	Soil treat	Marketable seedlings			Soil treat	Seedlings dead from damping off		
		Year		Mean		Year		Mean
Soil + compost		1999/2000	2000/2001		1999/2000	2000/2001		
	1	93.84	88.71	91.27	1	2.99(9.84)	9.46(17.64)	6.22
	2	84.17	78.07	81.12	2	11.36(19.52)	17.15(24.47)	14.25
	3	96.19	86.18	91.18	3	2.14(8.30)	10.60(18.75)	6.37
	4	88.34	78.06	83.20	4	9.31(17.69)	20.99(27.01)	15.15
	5	82.96	73.14	78.05	5	14.00(21.67)	25.46(29.94)	19.73
Soil + sand + compost	1	93.05	84.60	88.82	1	4.91(12.55)	13.35(21.41)	9.13
	2	87.00	86.46	86.73	2	10.74(18.72)	11.94(20.00)	11.34
	3	89.19	89.59	89.39	3	7.68(15.86)	8.32(16.52)	8.0
	4	79.73	89.10	84.41	4	16.34(23.78)	9.87(18.29)	13.10
	5	90.51	76.09	83.30	5	6.85(15.04)	22.11(27.97)	14.48

Note 1: Soil treatments are 1= Formalin drenching, 2= Solarization, 3= Soil burning, 4= Agronomic soil and 5= Control

Note 2: Values in parenthesis are arc sine transformed data.

The data analysis of this research showed that formalin drenching is the best method for damping off control, which tallies the recommendation of Lumle experiment (formalin drenching). Despite, this recommendation, farmers does not apply formalin in the nursery plot. However they are facing the problem of damping off, which, is their number one problem in their ranking. The reason of it might be it is tedious work for them. Formalin

application is a lengthy process. Drenching of plots, covering soil by plastic sheet, removing of plastic sheet

**Table 2.** Statistical significance of the cauliflower seedlings over the years 1999/2000 and 2000/2001.

Recorded parameters	Marketable		Seedlings dead from damping	
	P value	LSD	P	LSD
Year	<0.001	2.532	<0.001	1.946
Soil Treatment	<0.001	4.003	<0.001	3.077
Soil Composition	0.218	2.532	0.628	1.946
Soil Trt x Soil Comp	0.142	5.661	0.070	4.352
Soil Trt x Soil Comp x Year	0.022	8.006	0.018	6.154

**Table3.** Effect of soil treatments and soil composition on the marketable seedlings and damping off severity of cabbage.

Marketable seedlings					Seedlings dead from damping off			
Soil comp	Soil treat	Year			Soil treat	Year		
		1999/20	2000/20	Mean		1999/2000	2000/2001	Mean
Soil + compost	1	91.55	88.12	89.84	1	3.21(10.34)	8.59(17.52)	5.90
	2	86.77	76.58	81.67	2	8.10(16.03)	19.34(25.99)	13.72
	3	88.76	85.79	87.28	3	6.99(15.25)	12.79(20.92)	9.89
	4	90.30	83.49	86.89	4	7.45(15.83)	14.59(22.40)	11.02
	5	72.11	82.11	77.11	5	22.97(28.66)	16.16(23.70)	19.57
Soil + sand + compost	1	95.67	87.87	91.77	1	2.45(7.49)	11.18(19.47)	6.82
	2	91.37	83.40	87.38	2	5.32(13.13)	13.10(21.16)	9.21
	3	90.05	85.27	87.66	3	5.52(13.59)	13.52(21.53)	9.52
	4	87.54	84.04	85.79	4	9.63(18.00)	12.97(21.11)	11.30
	5	84.34	85.96	85.15	5	13.72(21.69)	13.32(21.67)	13.52

Note 1: Soil treatments are 1= Formalin drenching, 2= Solarization, 3= Soil burning, 4= Agronomic soil and 5= Control

Note 2: Value in parenthesis are arc sine transformed data.

**Table 4.** Statistical significance of cabbage seedlings survival and dead seedlings in the year 2000/2001

Recorded parameters	Marketable		Seedlings dead from	
	P value	LSD	P value	LSD
Year	<0.001	1.791	<0.001	1.324
Soil Treatment	<0.001	2.832	<0.001	2.093
Soil Composition	0.002	1.791	0.010	1.324
Soil Trt x Soil Comp	0.013	4.005	0.072	2.961
Soil Trt x Soil Comp x Year	<0.001	5.664	<0.001	4.487

and exposing of soil and waiting for two weeks for seed sowing. The next important reason is formalin is poisonous and not eco friendly. In order that, the next alternate methods

shows by this experiment to check the damping off disease is soil burning. Soil burning method should be pushed up to damping off control. This method is easy to apply and local materials used in this method. This method do not polluted the environment and farmers don't need to wait long time for seed sowing.

## **CONCLUSION**

The data analysis of nursery experiment have shown that formalin drenching and soil surface burning are effective to minimizes the damping off pathogens and significantly increase the seedlings survival. Both of the cauliflower and cabbage indicate the similar results on different parameters. The different level of soil composition does not produce any satisfactory results. Somewhere mixtures of sand in nursery bed have resulted in better control of pathogens. It clearly indicates that soil porosity is necessary to control damping off incidence in nursery bed. However, it should be further investigate to conclude the better result. From the data and result of this experiment concluded that sterilization of nursery bed before seed sowing by formalin and burning method are effective measures to reduce damping off pathogens and increase the marketable seedlings of cauliflower and cabbage for rainy season. 2.5 % formalin solution 4 lit/m<sup>2</sup> drenching for moisten 4 inch soil before 21 days of seed sowing has better performance in soil sterilization and damping off control. Burning of 2.5 inch thick rice husk/ saw dust as a slow burning material before seed sowing on the surface of nursery bed will decrease the damping off pathogens. Formalin should be drenched in soil before 21 days of seed sowing. After drenching soil should be cover by plastic sheet for 7 days to check the formaldehyde gas. After 7 days sheet should be remove and soil should be exposed for 14 days. In the burning method nursery bed should be sterilize by burning 2.5 inch thick any slow burning materials before seed sowing.

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