Research Note

EVALUATION OF EFFICACY OF CHEMICAL, BOTANICALS AND BEEJAMRUT IN GROWTH PROMOTION AND MANAGEMENT OF DAMPING OFF DISEASE IN CAULIFLOWER AT UDAYAPUR, NEPAL

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ABSTRACT

Vegetable contributes 20.74% of the total Agricultural Gross Domestic Products (AGDP) of the country. Among the vegetables produced, cauliflower (*Brassica oleracea* L. var. botrytis) is one of the important vegetable crops in Nepal. Soil borne pathogens (soil inhabitants and soil transients) are one of the major factors contributing to lower yield in vegetables either through damage of whole crop, or by making them unmarketable. Damping off caused by *Pythium, Fusarium, Rhizoctonia*, *Phytophthora* is one of the major disease of vegetables crops. This disease attacks a crop in its two stages i.e. pre-emergence of seeds and in seedling stage. This study was conducted in a sick plot at Ghumne 5 of Belaka Municipality, Udayapur, Nepal with six treatments, each replicated four times. The pathogen causing damping off was identified as *Rhizoctonia* sp. Among the treatments Beejamrut was found to be superior to other treatments in terms of root length (5.97±0.62cm) and shoot length (13.25±1.16cm). In case of root weight and shoot weight Beejamrut (0.28±0.03g;1.85±0.50g), respectively, gave the similar results to Thiram (0.27±0.01g;1.89±0.4g), respectively. Lowest Percentage Disease Incidence (PDI) was found in Thiram (18.0±1) and Beejamrut (19.0±1) treated plots.

Key words: Soil borne pathogens, vegetables, Percentage Disease Incidence

INTRODUCTION

Vegetable cultivation in Nepal with the total area of 245037 ha and total produce of 3298816 t, and productivity of 13.46 t/ha contributes 20.74% of the total Agricultural Gross Domestic Products (AGDP) of the country (MoAD, 2012). Among the vegetables produced, cauliflower (*Brassica Oleracea* L. var. botrytis) is one of the important vegetable crops in Nepal preferred by the people for its taste and there is total production of 7054 t from 495 hectares of land (MoAD, 2012). Although it is liked by many people there are many constraints for the successful production of these vegetables. Soil borne pathogens are one of the major factor contributing to lower yield in vegetables crops. Loss in the vegetables are reported to be about 26 percent of the total yield of crops in a global scenario either through damage of whole crop or by making them unmarketable (khan et. al, 2009). There are two types of pathogens (soil inhabitants and soil transients) that cause soil borne diseases. Soil inhabitants are those which can form long lived survival structure and wider host range. They persists in soil for longer period by developing resistant survival structure such as chlamydospores, oospores and sclerotia (Baysal-Gurel et. al, 2012) and soil transient or soil invaders remain in soil for short time (Koike et. al, 2003). Soil borne disease caused by different pathogens (*Pythium, Fusarium, Rhizoctonia, Phytophthora*) are causing problems in the successful crop production and are the main reasons for low yield (Shafique et al., 2016).

Damping off is one of the major diseases caused by these soil borne pathogen which is generally most severe under conditions of high soil moisture and/ or compaction, overcrowding, poor ventilation and cool, damp, cloudy weather. Seedlings are most susceptible to damping-off prior to emergence or within the first week after emergence (Gramzow et. al, 2017). Damping-off may affect from 5 to 80% of the seedlings, thereby inducing heavy economic consequences for farmers (Lamichhane et. al, 2017).

Pathogens enter the seedlings through their roots or come in contact with the seeds and cause symptoms of seed damage, wilting and rotting of young succulent plants. Economic loss due to damping off are cost due to damage of seed/seedlings, cost required to replace those seeds/seedlings and yield loss due to late planting (Lamichhane *et. al*, 2017). Symptoms of these damping-off diseases are seen in plants in two phases, one is seeds decay prior to emergence and is called as pre-emergence damping off and another is after the emergence of seedlings in the soil surface known as post-emergence damping off. In pre-emergence damping-off the young seedlings are killed before they reach to the soil surface just after the emergence of hypocotyl. As soon the radicle and plumule comes out from the seed coat they are destroyed which remains unnoticed. During the post-emergence damping-off, seedlings come out from the soil surface and on being infected they topple over and lie down on the surface of the soil due to killing of the host tissue by the pathogen at or below the soil surface. In the later stage the stem near the soil surface becomes constricted and collapses (Lamichhane et. al, 2017).

For the management of these diseases it is important to create high competition with secretion of antibiotics by some beneficial organism and direct parasitism by other microbes. This will create a tough environment for these pathogens (Sullivan, 2001).The concept of management of diseases employing eco-friendly materials gained momentum as mankind became more and more environment conscious. Use of botanicals and other options instead of chemical fungicides is one of the recent approaches for plant disease control, as fungicides may cause health hazard and may directly increase environmental pollution (Islam & Faruq, 2012). It is a need of this period to find out eco-friendly solution that would help in the management of the disease being at par with the agro-chemicals. The study carried out tries to identify the best option for the management of the soil borne disease that not only plays role in disease control but also plays role in growth promotion of the seedlings raised and is also cost effective and reachable to subsistence Nepali farmer.

MATERIAL AND METHODS

This study was done in a sick plot of Ghumne 5 of Belaka Municipality of Udayapur district that lies in the eastern part of Nepal. The experiment was conducted with six treatments, each replicated four times (Thiram @ 2 g/L, Beejamrut (100 ml), onion extract (10 %), Garlic extract (10 %), Neem extract (10 %), and Control). Seeds of Cauliflower were treated with the treatments before 24 hours of sowing and control was treated with clean water. The experiment was done by using Randomized Complete Block (RCBD). The disease was recorded 20 days after the seedling was sown in the nursery and percentage disease incidence was calculated by using the formula (Sethumadhava et. al, 2016):

$$\textbf{Percentage of disease incidence (PDI)} = \frac{\text{Total number of Infected plants}}{\text{Total number of plants assessed}} \times 100$$

Other parameters taken during the study were root length, shoot length, root weight and shoot weight. The diseased sample was sent to Agriculture and Forestry University (AFU), Rampur, Chitwan for the identification of pathogen. The data were entered in a excel sheet and were analyzed with R stat. Mean comparison of the treatments were done through Duncan Multiple Range Test (DMRT) and the significance of difference among the means was calculated by LSD (least Significant Difference) test.

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RESULTS AND DISCUSSION

Among the disease plant sample sent to agriculture and Forestry University (AFU) for the identification, soil borne pathogen was identified as *Rhizoctonia* sp. Findings revealed that there was a significant difference ($p<0.05$) among the treatments for root length, shoot length, root weight and shoot weight. In the case of root length, highest root length (5.97±0.62) was found in Beejamrut treated plot which was statistically at par ($p>0.05$) with Thiram (5.35±0.25) and garlic (5.37±0.62) treated plots. Lowest root length was found in control plot (3.5±0.75). Highest shoot length was found in Beejamrut (13.25±1.16), Garlic (13.05±0.60) and Thiram (12.98±0.87) and Lowest Shoot length was observed in Control (9.86±0.87). Similarly Highest root weight was found in Beejamrut (0.28±0.03) and Thiram (0.27±0.01) whereas lowest root weight was found in Control (0.15±0.01). The maximum shoot weight was found in Thiram and Beejamrut treated plots (1.89±0.4) and (1.85±0.50), respectively, whereas minimum shoot weight was found in control treated plots (1.26±0.21) (Figure 1).

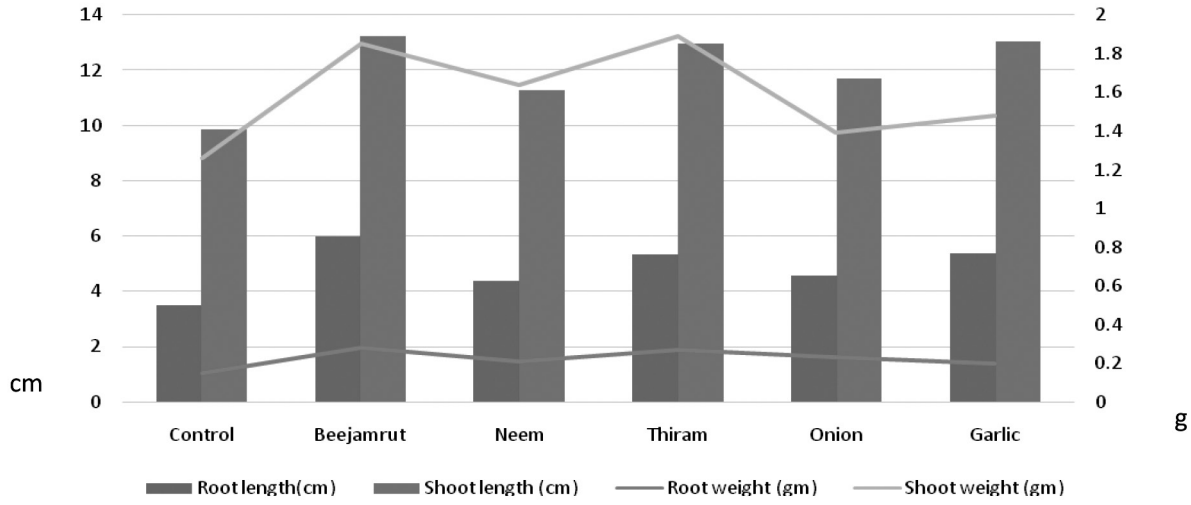

Figure 1. Effect of various treatments on growth promoting parameters of a Cauliflower at Ghumne 5 Belaka Municipality, Udayapur 2019

There was found highly significant difference ($p<0.001$) between the Percentage Disease Incidence (PDI) among the various treatments. PDI was found highest in the control treated plot (36.5±1.5) and was lowest in the Thiram treated plot (18±1) and Beejamrut treated plot (19±1) (Table 1).

Table 1. Percentage Disease Incidence (PDI) of various treatments against Damping off disease at Ghumne 5 Belaka Municipality, Udayapur 2019

Treatments	Percentage Disease Incidence (PDI)
Control	36.5±1.5c
Beejamrut	19.0 ±1a
Neem	28.0±2bc
Thiram	18.0 ±1a
Onion	20.5±2abc
Garlic	22.5±2.5ab
P value	2.7e-08***
CV	9.04
LSD	3.28
GM	24.08

From the results obtained, the effect of Beejamrut was notable and at par to other treatments (Table 1), which may be due to the components of Beejamrut showing their effects against the pathogen and presence of growth promoting factors in it. The major components of Beejamrut are cow urine and cow dung. Growth promoting bacteria such as *Azospirillum*, *Azetobacter* and *Pseudomonas* (Solaiappan, 2002) and growth promoting and antagonist fungus like *Aspergillus*and *Trichoderma* (Girija*et. al,* 2013) that are widely used as bio-fertilizers are found large in numbers in cow dung and cow urine. According to (Radha& Rao, 2014) these growth promoters present in the components of Beejamrut directly or indirectly affect in growth promotion. Production of auxins, gibberellins and cytokinin supply biologically fixed nitrogen and solubilize insoluble phosphates which is the direct effect and "indirect mechanism includes suppression of bacterial, fungal and nematode pathogens by production of siderophores, HCN, ammonia, antibiotics, volatile metabolites etc., by induced systemic resistance and by competing with the pathogen for nutrients or for colonization of space." According to (Howell, 2003) *Trichoderma* helps in bio-control of plant disease through mycoparasitism, antibiotic (toxin) production, competition, secretion of enzymes, induction of defence response in plants and growth stimulation.

The results obtained are also in agreement with (Sreenivasa, 2009; Phate et. al, 2014) which states that, Beejamrut along with the general microflora also contains certain beneficial biochemical groups like free living

nitrogen fixers, phosphate solubilizers and bacteria that produce plant growth promoting substances that may have increased in the improvement of seed germination, seed length and seed vigor.

CONCLUSION

Beejamrut was found superior in growth promotion to other treatments that had similar response in damping off management to chemical Thiram. Thus it can be concluded that Beejamrut can be one of the options for the management of the damping off disease that not only plays role in disease control but also plays role in growth promotion of the seedlings raised which is cost effective and easily reachable to subsistence Nepali farmer.

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