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Cost: benefit analysis of botanicals against leaf spot of mungbean (*Vigna radiata* L.) Caused by *Cercospora canescens*

MK Sheshma, SS Kakraliya and Dhanni Devi

Abstract
The present experiment was conducted under *in vivo* conditions to observe the effect of botanicals against *Cercospora canescens.* Six treatments with three replications were taken in Randomised Block Design. To manage the disease an investigation was carried out in the research laboratory of Department of Plant Pathology, SHIATS-DU, Allahabad where the efficacy of different plant extracts *viz*. Neem (*Azadirachta indica*), Dhatura (*Datura stramonium*) Garlic (*Allium sativum*) Arjun (*Terminalia arjuna*), Aswagandha (*Withania somnifera*) and Alovera (*Aloe barbadensis*) @ 10% against *Cercospora canescens* were evaluated. *Azadirachta indica* was found to be the most effective treatment and recorded minimum disease intensity (25.69%), maximum no. of pod per plant, maximum weight of pod (g) and yield (q/ha) followed by *Terminalia arjuna*, Alovera leaf, *Withania somnifera*, *Datura stramonium* and *Allium sativum*. The cost of each treatment including material and labour were calculated and the revenue of each derived using the value of the marketable yield of mungbean. The cost: benefit ratios of sprayed treatments were derived by comparing the cost of each plant protection regime against the additional market value of the treatment yield above that obtained in the control treatment. With the exception of plots sprayed with botanical, the cost of plant protection using Attack was higher than any of the botanicals in both seasons. The highest cost: benefit ratio of 1: 2.23 was observed for plots sprayed with extract of neem leaf @ 10% as compared to untreated control (1: 1.14) followed by Arjun leaf @ 10% (1: 2.13), Alovera leaf @ 10 (1: 2.08), Aswagandha leaf @ 10% (1: 1.85), Dhatura leaf @ 10% (1: 1.80) and Garlic clove @ 10% (1: 1.51). Botanical agents differed markedly in levels of disease control and cost: benefit but some were comparable to that from conventional fungicides use whilst being produced easily from locally available plant materials and are likely to be safer to use for smallholder farmers and consumers in developing countries.

Keywords: Botanicals extract, *Cercospora canescens*, mungbean, economics, yield loss

Introduction
Mungbean (*Vigna radiate* L.), belongs to the family Leguminosae and sub family Papilionaceae. Pulses are major sources of proteins among the vegetarians in India and complement the staple cereals in the diets with proteins, essential amino acids, vitamins and minerals. It contains 22-24% protein, which is almost twice the protein in wheat and thrice that of rice. Pulses provide significant nutritional and health benefits and are known to reduce several non-communicable diseases such as colon cancer and cardio-vascular diseases. Among various pulse crops, chickpea dominates with over 40 percent share of total pulse production followed by pigeon pea (18-20%), mungbean (11%), urdbean (10-12%), lentil (8-9%) and other legumes (20%) (Laxmipathi *et al.*, 2013) [20]. Presently, the per capita share of pulses in nutrition supply in India with respect to energy, protein and fat is 117.4 K cal, 6.9 g and 1.0 g per day respectively. An adult male and female requires 80 and 70 g per capita per day, respectively for balanced diet (Anonymous, 2004) [10]. The crop is generally grown during *kharif* as rainfed crop. It has the yield potential of 11 to 12 q ha^{-1} (Anonymous, 2004) [10], as against the national average of 4.17 q ha^{-1}. Among various factors responsible for low yields, biotic and abiotic stresses take a heavy toll of the crop, out of which diseases cause an estimated yield loss of 21.93 to 68.77% (Sharma *et al*., 2008). Mungbean crop covers a total world area of 5 m ha with a total production of 3 m ton (John, 1991). India's contributing 23% global pulses in world production from an area of about 12.08% (Anonymous, 2012) [11]. Mungbean suffers from many diseases caused by fungi, bacteria, viruses, nematodes and also abiotic stresses. In green gram, considerable losses in the production occur as a result of Cercospora leaf spot (*Cercospora canescens*), anthracnose (*Colletotrichum lindemuthianum*),

powdery mildew (*Erysiphe polygoni)*, bacterial blight (*Xanthomonas phaseoli)*, rust (*Uromyces appendiculatus)*, leaf crinkle and yellow mosaic virus. Among these, Cercospora leaf spot is a serious problem in all the areas having rice based cropping systems of the country (Abbaiah, 1993). Grain yield losses have been reported up to 23% due to Cercospora leaf spot in mungbean (Quebral and Cagampang, 1970) [22]. Maximum loss of 61% was observed in case of grain yield (Iqbal *et al.*, 1995) [17]. The disease starts appearing about 30 days after sowing (Grewal *et al.*, 1980) [15].

Materials and Methods

In-situ experiment

In situ experiment (field) was laid out in randomized block design (RBD) with six treatments *viz.* Neem leaf extract @ 10%, Arjun leaf extract @ 10%, Alovera leaf extract @ 10%, Aswagandha leaf extract @ 10%, Dhatura leaf extract @ 10%, Garlic clove extract @ 10% and three replications including inoculated check in the experimental field of SHIATS-DU, Allahabad in *Zaid* season (Feb. 2015 to May 2015). Each replication consisted of 21 plots of 2×1 m^2 each. The seeds *cv.* "Pant mung-1" was sown in February with a spacing of 10 x 45cm. Botanicals were sprayed just after initiation of disease and repeated three at 15 days interval. Plots without spray serves as check and the observations were recorded in five selected tagged plants 3 days after last sprays of botanicals using 0 to 9 grade scale (Kapadiya and Dhruj, 1999) [19]. The data was subjected to the statistical analysis.

Source and preparation of extracts

The plants *viz.*, Neem, Garlic, Alovera, Dhatura, Arjun leaf and Aswagandha were selected for the study. Healthy non infected leaves of the six plants were collected from the local area. Leaves/ rhizomes of the test botanicals were washed first in tap water, then in distilled water. Then 100 g of plant tissues + 100 ml distilled water were crushed (1:1 w/v) in mortar and pestle. The extract was filtered through double layered of muslin cloth. The filtrate thus obtained was centrifuged at 5000 rpm for 15 min. The supernatant was collected and pellet was discarded. The supernatant obtained was strained through Whatman No.1 filter paper and filtrate thus obtained was used as stock solution (100% conc.) (Nene and Thapliyal, 1993) [21].

Disease intensity (%) was calculated by using the following formula

$$\text{Disease intensity (\%)} = \frac{\text{Sum of all disease rating}}{\text{Total number of leaves/plant X Maximum disease grade}} \text{ X } 100$$

Cost: Benefit

In 2015 season, the best cost: benefit ratio of 1:2.23 was for *Azadirachta indica*, followed by 1: 2.13 for *Terminalia arjuna* while the lowest was 1: 1.51 for *Allium sativum* sprayed plots.

Calculation of C: B ratio: Cost benefit ratio was calculated using formula and following the work done by Mahapatra and Das (2017) [1].

$$\text{C: B ratio} = \frac{\text{Additional income from protection}}{\text{Cost of protection}}$$

Costs: The costs of plant protection were recorded in field experiment conducted during the late planting season of 2015. Cost of purchase of some plant materials from the local market were recorded while for some other plant materials obtained from the immediate vicinity of the institute was costed via the associated cost of labor for their collection. Also the cost associated with the purchase of ethanol used for the extraction was recorded. The amount for purchase of plant extract, which is the botanical against was also recorded. Labour cost for preparation and spray of the botanicals were recorded. Throughout the study, labour cost was based on the existing wage rate for an unskilled labour at the locality at the time of the study which was one thousand naira (N 1,000.00) per man day. A total of 5 days of labour were used for collecting and preparing the botanicals for each of the botanical treatments. There were a total of five sprayings during the life-span of the experiments. The externalities such as potential impacts on the environment, natural enemies, farm workers and consumer safety associated with each of the treatments were not considered in the analysis. The totality of these cost represent the total cost of plant protection.

Economic Analysis

The number of pod per plant and weight per plant for each experimental year were subjected to analysis of variance (ANOVA) using Genstat statistical package and means separated by LSD at 5% level of probability. Total income was obtained by multiplying the total yield per hectare by the prevailing market price; while the net benefit was obtained by subtracting the total cost of plant protection from total income. Benefit over the control for each sprayed treatment was obtained by subtracting the income of the control treatment from that of each sprayed treatment. The cost: benefit ratio of each treatment was derived by subtracting the income of the control treatment from the net income of each sprayed treatment and the products were divided by total cost of plant protection for each treatment.

Results and Discussion

The result presented in Table-1 revealed that all the treatments were statistically significant and recorded minimum disease intensity as compared to control. Among the botanicals used the minimum per cent disease intensity was recorded in *Azadirachta indica* @ 10% (25.69%) as compared to untreated control (44.24%). *Azadirachta indica* treatment was followed by *Terminalia arjuna* (29.37%), *Aloe barbadensis* (30.39%), *Withania somnifera* (31.87%), *Datura stramonium* (33.69%) and *Allium sativum* (35.03%). Among the treatments lowest per cent disease intensity was recorded in *Azadirachta indica* (25.69%). The maximum number of pods per plant was recorded in plots treated with *Azadirachta indica* (7.49%) as compared to untreated control (4.52%). *Azadirachta indica* treatment was followed by *Terminalia arjuna* (7.16%), *Aloe barbadensis* (6.15%), *Withania somnifera* (6.05%), *Datura stramonium* (5.80%) and *Allium sativum* (5.34%).

Among the botanicals used the maximum weight of pod/plant (g) was recorded in *Azadirachta indica* (4.92g) as compared to untreated control (2.47g). *Azadirachta indica* treatment was followed by *Terminalia arjuna* (4.76g), *Aloe barbadensis* (4.12g), *Withania somnifera* (3.97g), *Datura stramonium* (3.63g) and *Allium sativum* (3.12g).

Table 1: Per cent disease intensity of Cercospora leaf spot, no. of pod/plant, weight of pod/plant and yield q/ha as affected by different treatments

Treatments	Disease intensity (%)	No. of pod/ plant	Weight of pod/ plant	Yield q/ha	C:B ratio
Control (Untreated)	44.24	4.52	2.47	3.69	1:1.14
Azadirachta indica	25.69	7.49	4.92	7.32	1:2.23
Allium sativum	35.03	5.34	3.12	5.13	1:1.51
Terminalia arjuna	29.37	7.16	4.76	7.01	1:2.13
Datura stramonium	33.69	5.80	3.63	5.93	1:1.80
Withania somnifera	31.87	6.05	3.97	6.12	1:1.85
Aloe barbadensis	30.39	6.15	4.12	6.87	1:2.08
F-test	S	S	S	S	
S. Ed. (±)	1.60	0.81	0.18	0.42	
C. D. (P = 0.05)	3.49	1.76	0.08	0.91	

The result presented in Table 2 revealed that all the treatments were statistically significant and the maximum grain yield (q/ha) was recorded in *Azadirachta indica* (7.32 q/ha) as compared to untreated control (3.69 q/ha). *Azadirachta indica* treatment was followed by *Terminalia arjuna* (7.01 q/ha), *Aloe barbadensis* (6.87 q/ha), *Withania somnifera* (6.12 q/ha), *Datura stramonium* (5.93 q/ha) and *Allium sativum* (5.13 q/ha). Among the treatments maximum grain yield (q/ha) was recorded in *Azadirachta indica* (7.32 q/ha). The best and most economical treatment was *Azadirachta indica* (1: 2.23) as compared to untreated control (1: 1.14). *Azadirachta indica* treatment was followed by *Terminalia arjuna* (1: 2.13), *Aloe barbadensis* (1: 2.08), *Withania somnifera* (1: 1.85), *Datura stramonium* (1: 1.80) and *Allium sativum* (1: 1.51). All the treatments were found statistically significant over control. The results of the present study are in accordance to the findings of the (Glove *et al*., 2014; Singh *et al*., 2010). They reported that *Cercospora canescens* by neem leaf extract could probably be due to the botanicals inducers which have direct antimicrobial effect and showing minimum disease intensity, maximum no. of pods per plant, maximum weight of pod (g), maximum yield (q/ha), *Cercospora canescens* due to neem leaf extract may have been due to secretion of extracellular cell degrading enzymes such as tannin, limonoid, triterpennoid, azadirectin, which may have helped mycoparasites in the colonization of their host.

Table 2: Cost: benefit ratio in loss estimation study due to *Cercospora canescens* as influenced by the number of sprays botanical against Cercospora leaf spot of mungbean

Treatments	Yield q/ha	Total cost of yield (Rs)	Common cost (Rs)	Total cost of labours/treatment	Total cost(Rs)	C:B ratio
Control (Untreated)	3.69	25830	22590	-	22950	1:1.14
Azadirachta indica	7.32	51249	22590	364	22954	1:2.23
Allium sativum	5.13	35910	22590	1100	23690	1:1.51
Terminalia arjuna	7.01	49070	22590	420	23010	1:2.13
Datura stramonium	5.93	41510	22590	420	23010	1:1.80
Withania somnifera	6.12	42840	22590	500	23090	1:1.85
Aloe barbadensis	6.87	48090	22590	420	23010	1:2.08

Discussion

Screening of some selected plant extracts *viz.*, Neem, Garlic, Alovera, Dhatura, Arjun leaf extract and Aswagandha showed less amount of Cercospora leaf spot disease on mungbean for *in vivo* antifungal activity. The results also proved that the plant extracts (Neem, Garlic, Alovera, Dhatura, Arjun leaf extract and Aswagandha) used the minimum disease intensity per cent was recorded in Neem leaf extract (25.69%) as compared to untreated control (44.24%). Neem leaf extracts treatment was followed by Arjun leaf (29.37%), Alovera (30.39%), Aswagandha (31.87%), Dhatura (33.69%) and Garlic clove (35.03%). Among the treatments lowest per cent disease intensity was recorded in Neem leaf (25.69%). Maximum number of pod per plant, maximum weight of pod (g) and yield (q/ha) in 2015 respectively over the unsprayed control treatment. Similar works by Adesegun *et al*., (2012) [3], Zarafi and Moumoudu (2010); Ogbebor and Adekunle (2008) revealed that *in vitro* and *in vivo* experiments using cold water extracts of Neem, Garlic, Alovera, Dhatura, Arjun leaf extract and Aswagandha could be used successfully as environmentally safe and economical fungicides against fungal diseases. Several studies reported the direct effect of neem leaf and fruit extracts on target pests and pathogens (Eppller 1995; Amadioha, 2000) [2]. The works of Wilson *et al.*, (1997) [7] on 345 plants extracts tested showed that Allium and Capsicum species were most effective. *Allium sativum* was demonstrated earlier to have good anti-fungal activity and useful as post-harvest treatment (Ark and Thompson, 1959), has not been commercialized.

Conclusion

This finding can be of some practical value to agricultural extension workers in the affected areas in advising farmers on the expected yield of their crop at various Cercospora leaf spot intensity. It could therefore, be concluded that the plant extracts Neem, Garlic, Alovera, Dhatura, Arjun leaf and Aswagandha were comparable to synthetic fungicide in reducing the amount of Cercospora leaf spot on mungbean. However, further evaluation of the materials using different parts, determination of the economic rate, formulation, packaging, method and frequency of application are needed.

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References

1. Mahapatra S, Das S. Assessment of yield loss of mustard

due to alternaria leaf blight in Gangetic plains of West Bengal. Indian Phytopathology. 2017;70(3):322-325.
2. AC Amadioha. Controlling rice blast *in vitro* and *in vivo* with extracts of *Azadirachta indica.* Crop Protection. 2000;19:287-290.
3. EA Adesegun, EO Ajayi, OS Adebayo, AK Akintokun, OA Enikuomehin. Effect of *Ocimum gratissimum* (L.) and *Aframomum melegueta* (K. Schum.) Extracts on the growth of *Sclerotium rofsii* (Sacc.). International Journal of Plant Pathology. ISSN 1996-0719/ DOI: 10.3923/JPP. 2012.
4. Zarafi, U Moumoudou. *In vitro* and *in vivo* control of pearl millet midrib spot using plant extracts. Journal of Applied Biosciences.35:2287-2293.
5. OA Akinbode, T Ikotun. Evaluation of some bioagents and botanicals in *in vitro* control of *Colletotrichum destructivum.* African Journal of Biotechnology. 2008;7(7):868-72.
6. AC Amadioha. rice blast *in vitro* and *in vivo* with extracts of *Azadirachta indica.* Crop Protection. 2000;19:287-290.
7. CI Wilson, JM Solar, A Ghaouth, ME Wisniewski Rapid evaluation of plant extracts and essential oils for antifungal activity against *Botrytis cinerea.* Plant Diseases. 1997;81:204-210.
8. Ark PA, Thimpson JP. Control of certain diseases of plants with antibiotics from garlic (*Allium sativum* L.). Plant Diseases Reports. 1959;43:276-282.
9. Abbaiah K. Development of powdery mildew epidemics in urdbean in relation to weather factors. Indian Journal of Pulses Res. 1993;6:186-188.
10. Anonymous Recommended dietary allowance for Indians. Survey of Indian Agriculture, Pub. The Hindu, pp. 2004;54.
11. Anonymous Directorate of Economics and Statistics, Department of Agriculture and Cooperation. Ministry of Agriculture, Government of India. 2012;30-33.
12. Didvania R shah, singh Jadon K. Efficacy of fungicides and botanicals a new disease of bell pepper (*Capsicum annuum var. grossum*) caused by Drechslera bicolor plant pathology Journal. 2012;11(2): 68-72.
13. Devi AP Mohan, S Thiribhuvan, amala G. Efficacy of phytoextracts and oils of certain medicinal plants against Cercospora moricola cooke incitant of mulberry (*Morusalba* L.) leaf spot, Journal of Biopesticides, 2013;6(2):231-236.
14. Gholve VM, Tatikundalwar VR, Suryawanshi AP, Dey U. Effect of fungicides, plant extracts/botanicals and bio-agents against damping off in brinjal. African Journal of microbiology Research. 2014;8(30):2835-2848.
15. Grewal JS, Machendra P, Kulshrestha DP. Control of Cercospora leaf spot of green gram by spraying Bavistin, Indian J. Agric. Sci. 1980;50:707-11.
16. Hossain MH, Hossain I. Screening of different plant extracts against leaf spot (*Cercospora arachidicola* and *Cercosporidium personatum*) of groundnut (*Arachis hypogaea* L.) Bangladesh J Agril. Res. 38(3):491-503.
17. Iqbal SM, Ghafoor A, Bashir M, Malik BA. Estimation of losses in yield components of mugbean due to Cersospora leaf spot. Pakistan J Phytopathol. 1995;7:80-1.
18. John MP. The Mungbean, Oxford and IBH Publishing Co. Pvt. Ltd., pp. 1991;375.
19. Kapadiya HJ, Dhruj IU. Management of mung bean Cercospora leaf spot through fungicides. Indian Pytopath, 1999;52(1):96-97.
20. Laxmipathi Gowda CL, Srinivasan S, Gaur PM, Saxena KB. Enhancing the productivity and production of pulses in India. 2013.
21. Nene YL, Thapliyal PN. Fungicides in plant disease control 3rd edition. Oxford and I B H. Publishing Co., Pvt. Ltd., New Delhi.1993,526.
22. Quebral FC, Cagampang IC. Influence of Cercospora leaf spot control on yield of mungbean. Agriculture at Los Banos. 1970;10:7-12.
23. Sharma PN, Sharma OP, Padder BA, Kapil R. Yield loss assessment in common bean due to anthracnose *Colletotrichum lindemuthianum* under sub temperate conditions of North- western in Himalayas. Indian Phytopathol. 2008;61:323-330.
24. Tunwari BA, Nahunnaro H. *In vivo* evaluation of some plant extracts on the control of Cercospora leaf spot (*Cercospora sesami*) on four sesame varieties in TARABA, NIGERIA I.J.S.N. 2014a;5(3):518-524.
25. Tunwari BA, Nahunnaro H. Effects of botanical extracts and a synthetic fungicide on severity of Cercospora leaf spot (*Cercospora sesame zimm*) on sesame (*Sesamum indicum*) yield attributes under screen house condition in Ardo-Kola, Taraba State, Nigeria. International journal of scientific & technology research. 2014b,3(1).
26. Uddin MN, Bakr MA, Islam MR, Hossain MI, Hossain A. Bioefficacy of plant extracts to control Cercospora leaf spot of mungbean (*Vigna radiate* L.) Int. J Agril. Res. Innov. & Tech. 2013;3(1):60-65.