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Assessment of natural farming practice against leaf spot (Tikka) disease of summer groundnut under central dry zone of Karnataka

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Abstract
Field experiments were conducted during summer season of 2019 and 2020 at Zonal Agricultural and Horticultural Research Station, Hiriyur, University of Agricultural and Horticultural Sciences, Shivamogga, to evaluate the efficacy of different farming practices against tikka disease in groundnut, the experimental results of two years pooled data revealed that significantly higher per cent disease reduction was noticed in RPP (53.48 and 67.91) respectively, over the control (PDC) after first and second spray, which was followed by organic practice (azadirchtin 0.03%EC) recorded 27.17 and 42.78 respectively and natural farming practices (neem leaf and kernel +desi cow dung and desi cow urine extract) showed 22.16 and 34.12 respectively over the control.

Keywords: ground nut, tikka disease, natural farming, early leaf spot and late leaf spot

Introduction
Groundnut (*Arachis hypogaea* L.) is the major oilseed crop of India, accounting for about 38 per cent of oilseed area and 48 per cent of total oilseed production, with an average pod yield around 900 kg/ha. The groundnut is affected by various diseases like early leaf spot, late leaf spot, rust, crown rot or seedling blight, stem rot and collar rot. Among the important fungal diseases, leaf spot caused by *Phaeosiariopsis personata* (Blerk. and Curt.), van Arx (late leaf spot) and *Cercospora arachidicola* Hori (early leaf spot) are the most serious diseases causing premature defoliation. Groundnut leaf spot is the most common in which early leaf-spots (ELS) *Cercospora arachidicola* and late leaf-spot (LLS) *Cercospora personatum* is mainly prevalent during the *kharif* than the *rabi* season. For example, a combined yield loss due to late leaf spot and rust was reported to be about 70 per cent [1, 2]. The groundnut early leaf spot (*Cercospora arachidicola*) and late leaf spot (*Cercosporidium personatum)* commonly called as “Tikka” disease. The early leaf spot (ELS) and late leaf spot (LLS) diseases are worldwide production problems of groundnut [3]. The spots begin to appear on one to two months old plants. ELS are sub-circular to irregular, 1 to 10 mm in diameter. Lesions are commonly dark (reddish) brown to black on the upper surface and light brown on the lower leaf surface. Leaf spot on upper surface is commonly surrounded by a yellow chlorotic halo. LLS are usually smaller and more nearly circular than early leaf spot lesions, 1 to 6 mm in diameter and are commonly dark gray or black on the lower leaf surface. There is no yellow halo around them. The LLS is usually more severe than ELS [4], late leaf spot caused by *Cercosporidium personatum* is the destructive foliar disease in groundnut. The most obvious effect of this disease is the loss of photosynthetic tissue, which leads to premature defoliation. Late leaf spot is almost co-existent with the crop and contributes to significant loss in yield throughout the world [5]. To minimize losses due to diseases, several methods of disease control on groundnut have been developed. However, the regular use of fungicides can potentially pose a risk to the environment, particularly if residues persist in the soil or migrate off-site and enter waterways (*e.g.* due to spray drift, run-off) [6, 7, 8, 9]. If this occurs it could lead to adverse impacts to the health of terrestrial and aquatic ecosystems. This in turn can have adverse effects on soil organisms (*e.g.* earthworms, microorganisms) and potentially pose a risk to the long-term fertility of the soil [10, 9]. To ensure the sustainability of production systems, a balance needs to be found between controlling disease risks to crops and protecting terrestrial and aquatic ecosystem. Hence, in recent years there has been increased awareness on toxic hazards of chemicals to crops, consumer and environment due to residual phytotoxity and pollution effects. So screening of plant products for their effective antifungal activity against the pathogen is essential to minimize the use of fungicide.

Therefore present study was conducted to known the effect of different management practices on tikka disease of groundnut under central dry zone of Karnataka.

Materials and methods

Field experiment was conducted at Zonal Agricultural and Horticultural Research Station, Babbur Farm, Hiriyur (ZONE-4) during 2019 and 2020 summer seasons to evaluate the efficacy of different management practices against foliar leaf spots disease of groundnut in relation to manage the leaf spots of groundnut. The local variety TMV-2 was sown as per different practices for higher yields. The trial was laid out in Randomized Block Design (RBD) with five replications with plot 20 × 10 m size. The different management practices were as T1- Natural Farming (Neemastra-5%), T2-Organic practices (Azadirchtin 0.03% EC), T3-Recommended Package of Practices (Hexaconazole 5% EC) and T4-control. The Per cent disease index (PDI) was computed by selecting five plants in each treatment at random and recording PDI as per 1-9 scale is given by Subrahmanyam *et al*. (1980)[11] and description given below in Table 1.

The recorded grade values were converted into Per cent Disease Index (PDI) by using following formula proposed by Wheeler (1969) [12].

$$\text{Per cent disease index (PDI)} = \frac{\text{Sum of the individual disease ratings}}{\text{Number of leaves observed} \times \text{Maximum disease grade}} \times 1\,00$$

The Per Cent Disease Control over was calculated by using the formula given by Vincent (1947) [13].

$$I = \frac{C - T}{C} \times 100$$

I= Per cent reduction
C= The per cent disease of control plot
T= The per cent disease of treated plot
The data was statistically analysed after suitable transformations.

Preparation of Neemastra-5 per cent concentration

Neem based products are extracted from the neem tree, *Azadirachta indica*, a member of the Meliaceae family [14]. The potent active ingredients of the neem are azadirachtin, meliantriol, salannin, desacetyl salannin, nimbin, desacetyl nimbin, and nimbidin.

Azadirachtin, a tetranortriterpenoid limonoid, is one of the most potent active compounds of the neem tree [15]. Azadirachtin is present in higher concentration (0.2 – 0.6%) in the seeds of the neem compared to other parts of the neem tree [16].

Ingredients: Neem leaves+ kernel (seed)-5 kg
Cow dung – 5 kg
Cow urine- 5 lit
Water-100 lit

Method of preparation

1. Neem leaves+ kernel was thoroughly crashed in cow urine
2. In 100 lit of water add crashed neem leaves and kernel and 5 kg cow dung
3. Keep it for 24 hours for fermentation
4. After 24 hours filter the extract with muslin cloth and spray directly to the infected field

Table 1: Description of leaf spots scale (1-9)

Leaf spot score	Description Disease severity	(%)
1	No disease	0
2.	Lesions largely on lower leaves; no defoliation	1- 5
3	Lesions largely on lower leaves; very few lesions on middle leaves; defoliation of some leaflets evident on lower leaves.	6- 10
4	Lesions on lower and middle leaves, but severe on lower leaves; defoliation of some leaflets evident on lower leaves.	11- 20
5	Lesions on all lower and middle leaves; over 50% defoliation of lower leaves.	21- 30
6	Lesions severe on lower and middle leaves; lesions on top leaves but less severe; extensive defoliation of lower leaves; defoliation of some leaflets evident on middle leaves.	31- 40
7	Lesions on all leaves but less severe on top leaves; defoliation of all lower and some middle leaves.	41- 60
8.	Defoliation of all lower and middle leaves; lesions severe on top leaves and some defoliation of top leaves evident	61- 80
9	Defoliation of almost all leaves leaving bare stems; some leaflets may be present, but with severe leaf spots.	81-100

Result and discussion

Field experiment was conducted at Zonal Agricultural and Horticultural Research Station, Babbur Farm, Hiriyur (ZONE-4) as explained in 'Material and Methods' to find out the efficacy of different farming practices for management of tikka disease of Groundnut during 2019 and 2020 *summer* seasons. Two sprays were given at fortnightly intervals starting from initiation of disease. The observations were recorded at 15 days after application (DAA) by using 1-9 scale as mentioned in material and methods and converted into Per Cent Disease Index (PDI) using the formula given by Wheeler (1969) [13] and calculated yield was statistically analyzed, data were presented in the Table 2.

During 2019 *summer* season, before treatment imposition PDI was non-significant and all the treatments remained on par or almost uniform with each other. After treatment imposition treatments started differed significantly after first and Second spray over control (Table 2). Hexaconazole 0.1 per cent sprayed plots treatment (RPP) showed least PDI after first and second spray (10.08 and 11.84 respectively) as compared to other treatments which is followed by organic practice treatment with azadirchtin 0.03%EC @ 2.5 per cent (16.48 and 20.64 PDI) and natural farming practice of neem seed and neem leaf extract at 5 per cent (17.28 and 24.64 PDI) respectively over the control.

In the second *summer* season (2020) there is no much significant differences among the treatments imposed with respect to the reduction of disease compared to first season. After two spray, Recommended Package of Practice with hexaconazole 0.1 per cent treated plot recorded least PDI

10.31 and 16.53 respectively after first and second spray compared to other treatments which is followed by organic practice treatment of neem oil @ 2.5 per cent (15.47 and 20.44 PDI respectively) and neem seed and neem leaf extract at 5 per cent of natural farming practices (16.80 and 22.67 PDI respectively) over the control. Pooled analysis of both season recommended package of practice showed significantly higher per cent reduction over the control in both first and second spray (53.48 and 67.91 respectively) compared to other practices and which is followed by organic practice (neem oil @ 2.5 per cent) 27.17 and 42.78 respectively and natural farming practice with neem seed and neem leaf extract at 5 per cent (22.16 and 34.12 respectively).

Among the different management practices tested in both seasons, recommended package of practice with hexaconazole treated plot has given good results. They were significantly superior to all other practices tested. Yang *et al*. (2011) [17] worked on mode of action and probable impact on non-target microorganisms by different fungicides and their combinations. They found that the most commonly used fungicides for management of powdery mildew like triazoles (hexaconazole, propiconazole and tebuconazole) act on lipid membrane and inhibits sterol synthesis, but they found that along with inhibiting sterol synthesis it had negative impact on non-target sites like affecting bacterial population that involved in nitrogen cycling. These results are comparable with findings of Khunti *et al.* (2002) [18] and Khunti *et al.* (2005) [19] who reported that hexaconozole effectively reduced the disease severity under *in vivo* condition. In order to overcome such hazardous control strategies and reduce the cost of cultivation, scientists, researchers from all over the world focused more towards the development of alternative methods which are, by definition, safe in the environment, non-toxic to humans and animals and are easily biodegradable, one such strategy is use of bio-control agents (BCAs) or botanicals to control fungal plant diseases.

Table 2: Per cent disease index of tikka disease (leaf spot) and yield of summer ground nut influenced by different practices during 2019, 2020 at Zonal Agricultural and Horticultural sciences, Babbur Farm, Hiriyur

Treatments	Concentration	PDI Before spray										
		Before 1st spray			15 DAS (1st spray)			% reduction over control	15 DAS (2nd spray)			% reduction over control
		2019	2020	Pooled	2019	2020	Pooled		2019	2020	Pooled	
T_1- Natural Farming	5 %	8.00 (16.21)	5.78 (13.78)	6.89 (15.04)	17.28 (23.83)	16.80 (23.49)	17.01 (23.64)	22.16	24.64 (28.46)	22.67 (27.29)	23.65 (27.88)	34.12
T_2- Organic Farming	2.5 %	8.32 (16.54)	5.87 (13.86)	7.09 (15.24)	7.09 (15.24)	16.48 (23.27)	15.47 (22.54)	27.17	20.64 (26.04)	20.44 (25.91)	20.54 (25.98)	42.78
T_3-Recommended Package of Practice (RPP)	0.1 %	8.96 (17.16)	6.67 (14.79)	7.81 (16.01)	7.81 (16.01)	10.08 (18.20)	10.31 (18.39)	53.48	11.84 (19.63)	11.20 (19.17)	11.52 (19.43)	67.91
T_4- Control	-	7.84 (16.05)	6.67 (14.79)	7.25 (15.42)	7.25 (15.42)	22.40 (27.13)	21.78 (26.75)		35.36 (34.09)	36.44 (34.60)	35.90 (34.35)	
S. Em±		NS	NS	NS	0.54	0.25	0.16		0.87	0.31	0.30	
CD at 5%					1.67	0.76	0.48		2.69	0.95	0.94	

*Arc sine transformation
DAA: Days After Application
Treatment Details:
T1-ZBNF – Neem leaf and Kernel +Desi Cow Dung and Desi Cow urine Extract (5 per cent)
T2- Organic Farming- Azadirchtin 0.03%EC (Azadirchtin 0.03%EC)
T3-Recommended Package of Practice (RPP) – Hexaconazole 5% EC
T4-Control

Conclusion

Among different management practices for management of leaf spot of *summer* groundnut during 2019 and 2020, the highest per cent reduction over control (67.91) was found in Recommended Package of Practices.

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