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Allelopathic effects of *Acacia nilotica* (L.) Leaf leachate with emphasis on *Trigonella foenum graceum* L. (fenugreek)

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Abstract
Present nursery-based investigation was carried out to study the allelopathic effects of *Acacia nilotica* (L.) on vegetable crop (*Trigonella foenumgraecum* L. *Acacia nilotica* (L.) leaf leachate was prepared by soaking the dry leaves in tap water for 24hours in a ratio of 1:10 weight by volume. The prepared leachate was diluted to three different concentrations *i.e.* 25, 50 and 75 per cent by adding tap water accordingly, thus there were five treatments of leachates (control, 25, 50, 75 and 100% concentration). On germination paper, germination trial results revealed that the increasing concentration of the leaf leachates had inhibitory effect on germination parameters, plumule and radicle length intest crop. In green house condition, similar result was revealed with respect to germination parameters. The leaf leachates had both stimulatory and inhibitory effect on growth (shoot and root height) though significantly and non-significantly in fenugreek respectively. The yield (fresh and dry weight) was affected by different concentration of leaf leachate. As compared to control, inhibitory effect was observed for fresh weight and dry weight. However, the analysis of soil i.e. pH, EC, N, P, K, OC reported that *Acacia nilotica* (L.) leaf leachate had improved the status of soil. From this we can predict that *Acacia nilotica* (L.) might possess allelochemicals that causes both suppressive and stimulatory ability where in fenugreek was negatively affected by higher concentration. The nursery study indicated that the effect was proportional to the concentrations of the extracts so that higher concentration has a stronger inhibitory or stimulatory effect.

Keywords: Agroforestry, allelopathy, leachate, allelochemicals, stimulation, inhibition, DAS (Days after sowing)

Introduction
Based on the Molisch's concept, Rice (1984) [18] defined Allelopathy as any direct or indirect positive or negative effect of one plant on the other (including the microbes) through the release of chemicals into the environment. However, the term is today generally accepted to cover both inhibitory and stimulatory effects of one plant on another plant.
Agroforestry is the major safeguard for lean periods by providing agriculture crops in association with trees which are very much useful for fuel, fodder and timber. Therefore, the choice of species combinations may profoundly affect the productivity and ultimate success of some agroforestry system.
Acacia nilotica (L.) commonly known as babul, kikar or Indian gum Arabic tree, has been recognized worldwide as a multipurpose tree (National Academy of Sciences 1980) [16]. *Acacia nilotica* (family Leguminosae, subfamily Mimosoideae). *Acacia nilotica* (L.) established as very important economic plants since early times as source of tannins, gums, timber, fuel, fodder, medicine, apiculture. So *Acacia nilotica* (L.) is selected as trees species to check allelopathic effect on *Trigonella foenumgraecum* (Fenugreek).

Materials and Method
For this experiment controlled condition in greenhouse size of each bed 2×4 ft. was selected. The matured leaves of *Acacia nilotica* (L.) were collected from the campus of Dr. PDKV, Akola. As for the vegetable seeds, it's procured from the local market. The matured leaves of *Acacia nilotica* (L.) were sun dried for 48 hours. Its leaf leachate was prepared by soaking the dried leaves in tap water for 24 hours at 1:10 proportion on weight by volume. The leaf leachate filtered with the help of cheese cloth and the leaf leachate of different concentrations i.e. 25, 50, 75 per cent was prepared by adding water to it, accordingly. Thus, there was five treatments including control as follows: T_1- Control (Tap Water), T_2- Leachate of 25%

concentration, T_3- Leachate of 50% concentration, T_4- Leachate of 75% concentration, T_5- Leachate of 100% concentration. (Chupitho, 2016) [7].

Freshly prepared leaf leachate was used to irrigate the crops under control condition in green house, for the study, using the seeds of *Trigonella foenum graceum* L. The seeds were sown in plot of nursery at the rate of 50 seeds per plot. The leaf leachate of different concentrations was used to irrigate the nursery bed. The crops were grown up to 30 days after which 5 seedlings of fenugreek crop for every treatment was randomly selected and marked with tag for taking for regular observation after which tagged plants were harvested to record the observation.

The soil samples from the nursery bed, which were used as a medium for the raising of the test crops, after harvesting of crops soil sample were collected in polythene bags for each treatment and replications and they were analyzed in the soil testing laboratory to determine their N, P, K, OC, pH and EC value (Dalvi, 2015 and Deshmukh, 2013) [8, 9]. For the analysis of data the statistical analysis of Variance (ANOVA) and OPSTAT software were used for the analysis as described by Sheoran Programmer, Computer Section, CCS HAU, Hisar.

Results and Discussion

Germinator

Seed germination

The data given in Table 1, depicted in Figure. 1, inhibitory effect of leaf leachates was observed on germination percentage except T_5.

Germination period

The data given in Table 2, depicted in Fig. 2, the fastest germination i.e. least germination period (3 days) was recorded the same in all, irrespective of the different treatments.

Germination value

The data given in Table 3, depicted in Fig. 3, the highest germination value of 14.86 was observed for T4 (75% concentration) and the lowest germination value of 10.05 was found for treatment T1.

Length of plumule

The data given in Table 1, depicted in Fig. 3, where inhibitory effect of leaf leachates was observed on plumule length of seedling. The maximum plumule length of seedling was observed in T1 (7.69 cm) and the minimum plumule length was recorded in T4 (6.14 cm).

Length of radicle

The data given in Table 1, depicted in Fig. 3, the inhibitory effect of leaf leachates was observed on radical length of seedling. The maximum radical length of seedling was observed in T1 (6.00 cm) while minimum length of radical was recorded in T4 (3.66 cm).

Greenhouse Condition

Germination

Germination Percentage

The data given in Table 2, depicted in Fig. 4, except T5 where inhibitory effect of leaf leachates was observed on germination percentage. The highest percentage of germination was found at control condition T1 and lowest in T4 86.6% was recorded.

Germination period

The data given in Table 2, depicted in Fig. 5, the germination of seeds started in 2 days after sowing and continued up to 6 days. The fastest germination i.e. least germination period (2 days) was recorded the same in all, irrespective of the different treatments.

Germination Value

The data given in Table 2, depicted in Fig. 5, the germination value under the different treatment is shown the highest germination value of 14.36 was found at T5 and lowest 9.94 was found in T2.

Shoot Height

The data given in Table 2, depicted in Fig. 6, On 15th day from sowing, the maximum height (13.31 cm) was found in T1 (control) and lowest i.e. 11.58 cm was found in T4. On 30th day of harvesting the result was found as follows. The maximum height (24.22 cm) was found in T1 (control) and minimum i.e. 19.61 cm was found in T4.

Root Height

The data given in Table 2, depicted in Fig. 6, As compared to control treatment, stimulatory effect was found in T2 (25%) on root height. The maximum height (8.88 cm) was found in T2 (25%) and lowest i.e. 7.82 cm was found in T5.

Shoot fresh weight

The data given in Table 2, depicted in Fig. 7, shows that, the shoot fresh weight was decreased as the increase concentration of leaf leachate. The maximum shoot fresh weight was observed in T1 (1.56 gm) and minimum shoot fresh weight was recorded in T4 (0.97 gm).

Root fresh weight

The data given in Table 2, and depicted in Fig. 7 shows that, the root fresh weight was decreased as the increase concentration of leaf leachate. The maximum root fresh weight was observed in T1 (0.087 gm) and minimum shoot fresh weight was recorded in T4 (0.053 gm).

Shoot dry weight

The data given in Table 2, and depicted in Fig. 7, shows that, all the treatments none significantly varied the shoot dry weight of fenugreek in comparison to control. The maximum shoot dry weight was observed in T1 (0.199 gm) and minimum was recorded in T4 (0.145 gm).

Root dry weight

The data given in Table 2, and depicted in Fig. 7 shows that, all the treatments none significantly varied the root dry weight of fenugreek in comparison to control. The maximum root dry weight was observed in T1 (0.022 gm) and minimum was recorded in T4 (0.0093 gm).

Soil Analysis

Soil pH

In fenugreek result Table 3, and depicted in Fig. 8, shows non-significant at depth 0-15 cm lowest pH observed in T1 (8.04) and highest in T5 (8.19). The highest pH value 8.30 was recorded in T5 having soil depth 15-30 cm and the lowest pH value of 8.02 was observed in T1. In that observation increasing concentration the pH also increases.

Electrical conductivity (ds/m)
In Table 3, and depicted in Fig. 8, result shows significant at depth 0-15 cm lowest EC observed in T1 (0.47) and highest in both T4 (0.54), T5 (8.19). The highest EC value 0.55 was recorded in T5 and T4 having soil depth 15-30 cm and the lowest EC value of 0.48 was observed in T1. In that observation increasing concentration the EC also increases.

Available nitrogen in soil (N) (kg/ha)
In Table 3, and depicted in Fig. 9, result shows significant at depth 0-15 cm lowest N observed in T1 (152.50) and highest in T4 (181.09). The highest N value T4 (174.00) lowest in T1 (147.03) having soil depth 15-30 cm. In that observation increasing concentration the N also increases except T5.

Available phosphorus in soil (P) (kg/ha)
In Table 3, and depicted in Fig. 9, result shows significant at depth 0-15 cm lowest P observed in T1 (21.83) and highest in T5 (24.48). The highest P value T5 (23.01) lowest in T1 (20.17) having soil depth 15-30 cm. In that observation increasing concentration the P also increases.

Available potassium in soil (K) (kg/ha)
In Table 3, and depicted in Fig. 9, result shows significant at depth 0-15 cm lowest K observed in T1 (282.2) and highest in T4 (294.55). The highest K value T4 (287.36) lowest in T1 (275.55) having soil depth 15-30 cm. In that observation increasing concentration the N also increases except T5.

Available organic carbon in soil (OC) (tones/ha)
In Table 3, and depicted in Fig. 8, which result shows significant at depth 0-15 cm lowest OC observed in T1 (5.00) and highest in both T4 (5.2) and T5 (5.2). The highest OC value in both T4 (4.90) and T5 (4.90) lowest in T3 (4.8), T2 (4.8), T1 (4.8) having soil depth 15-30 cm. In that observation increasing concentration the OC also increases.

Table 1: Effect of *Acacia nilotica* (L.) leaf leachate on germination percentage, least germination period, germination value, length of plumule, length of radical of fenugreek (germinator)

Treatment	Germination %	Least germination period	Germination value	Length of plumule (cm)	Length of radical (cm)
T1-control	95.00	4	10.05	7.69	6.00
T2-25%	89.00	3	10.55	7.32	5.27
T3-50%	92.00	3	13.84	6.70	4.00
T4-75%	86.50	3	14.86	6.14	3.66
T5-100%	95.00	3	12.27	6.60	4.66
CD @ 1%	8.96	1.64	11.42	0.88	0.29

Table 2: Effect of *Acacia nilotica* (L.) leaf leachate on germination percentage, least germination period, germination value, shoot and root height, Shoot and root fresh weight, shoot and root dry weight of fenugreek (greenhouse condition)

Treatment	Germination %	Least germination period	Germination value	Shoot height (cm)		Root height 30 DAS (cm)	Shoot fresh wt (gm)	Root fresh wt (gm)	Shoot dry wt (gm)	Root dry wt (gm)
				15 DAS	30 DAS					
T1-control	87.00	3	10.17	13.31	24.22	7.93	1.56	0.087	0.199	0.022
T2-25%	81.50	3	9.94	11.67	23.80	8.88	1.51	0.080	0.197	0.017
T3-50%	80.00	3	11.88	11.96	20.60	8.33	1.24	0.061	0.168	0.015
T4-75%	64.50	2	13.05	11.58	19.61	8.86	0.97	0.053	0.145	0.009
T5-100%	67.00	2	14.36	12.10	22.75	7.82	1.39	0.063	0.169	0.019
CD @5%	3.25	2.59	5.99	4.75	9.59	2.62	0.54	0.023	0.07	0.009

Table 3: Effect of *Acacia nilotica* (L.) leaf leachate on pH, EC, N, P, K, OC in soil of fenugreek

Treatment	pH		EC (ds/m)		N (kg/ha)		P (kg/ha)		K (kg/ha)		OC(tones/ha)	
	0-15 cm	15-30 cm	0-15 cm	15-30 cm	0-15 cm	15-30 cm	0-15 cm	15-30 cm	0-15 cm	15-30 cm	0-15 cm	15-30 cm
T1-control	8.04	8.12	0.47	0.48	152.50	147.03	21.83	20.17	282.2	275.55	5	4.8
T2-25%	8.07	8.19	0.50	0.52	169.03	160.56	22.99	21.21	288.88	280.37	5.1	4.8
T3-50%	8.11	8.22	0.51	0.53	177.97	169.03	23.18	22.04	291.01	282.56	5.1	4.8
T4-75%	8.14	8.27	0.54	0.55	181.09	174.00	23.43	22.68	294.55	287.36	5.2	4.9
T5-100%	8.19	8.30	0.54	0.55	179.82	171.88	24.48	23.01	293.08	285.93	5.2	4.9
CD @5%	0.22	0.30	0.014	0.019	5.00	6.26	0.67	0.79	8.05	7.54	0.13	0.09

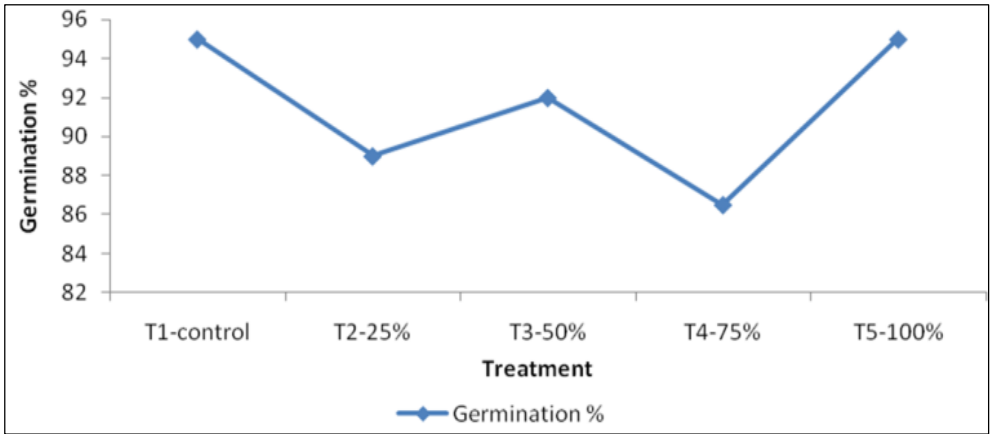

Fig 1: Effect of *Acacia nilotica* (L.) leaf leachate on germination % of fenugreek (germinator)

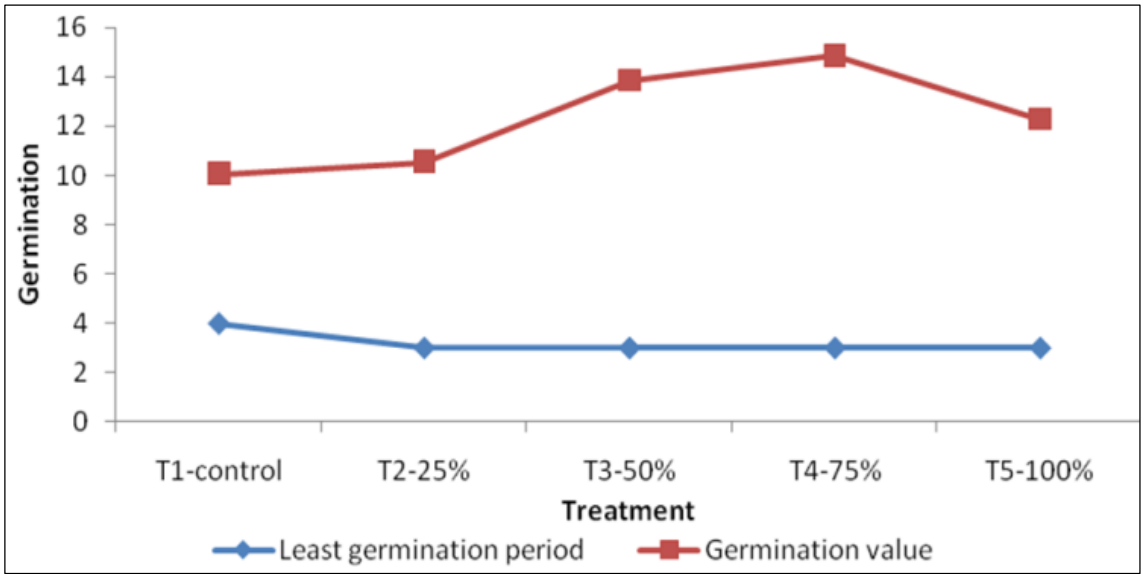

Fig 2: Effect of *Acacia nilotica* (L.) leaf leachate on germination period and germination value of fenugreek (germinator)

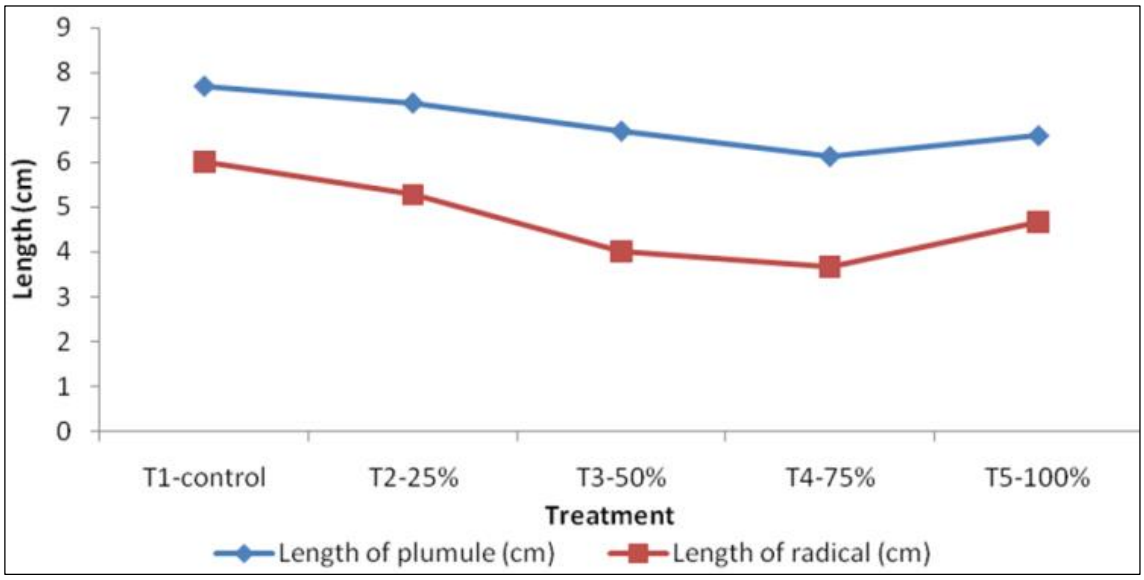

Fig 3: Effect of *Acacia nilotica* (L.) leaf leachate on plumule radicle length (cm) of fenugreek (germinator)

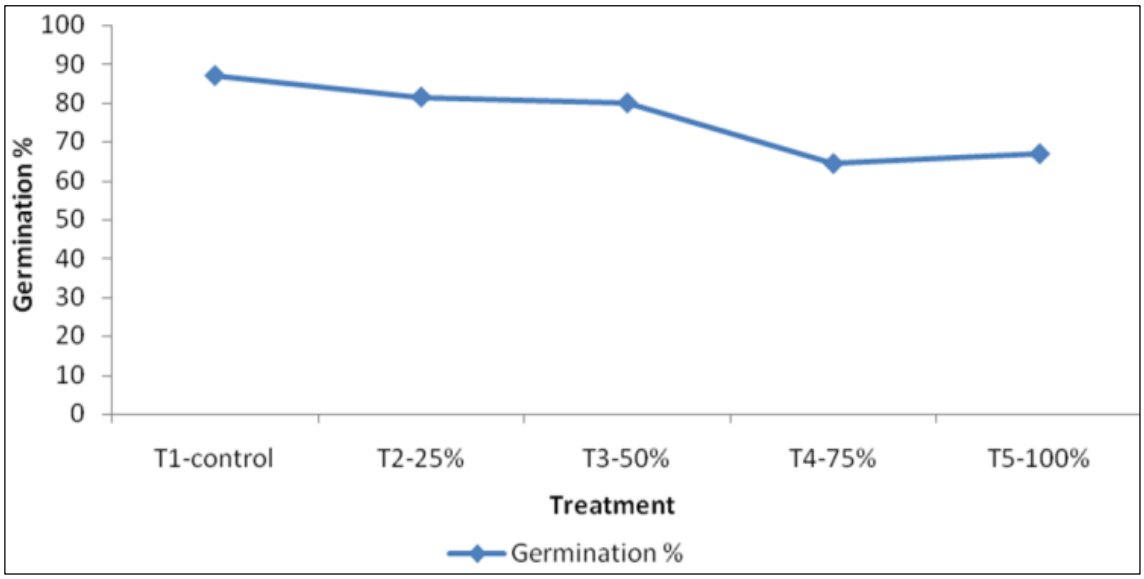

Fig 4: Effect of *Acacia nilotica* (L.) leaf leachate on germination % of fenugreek (greenhouse condition)

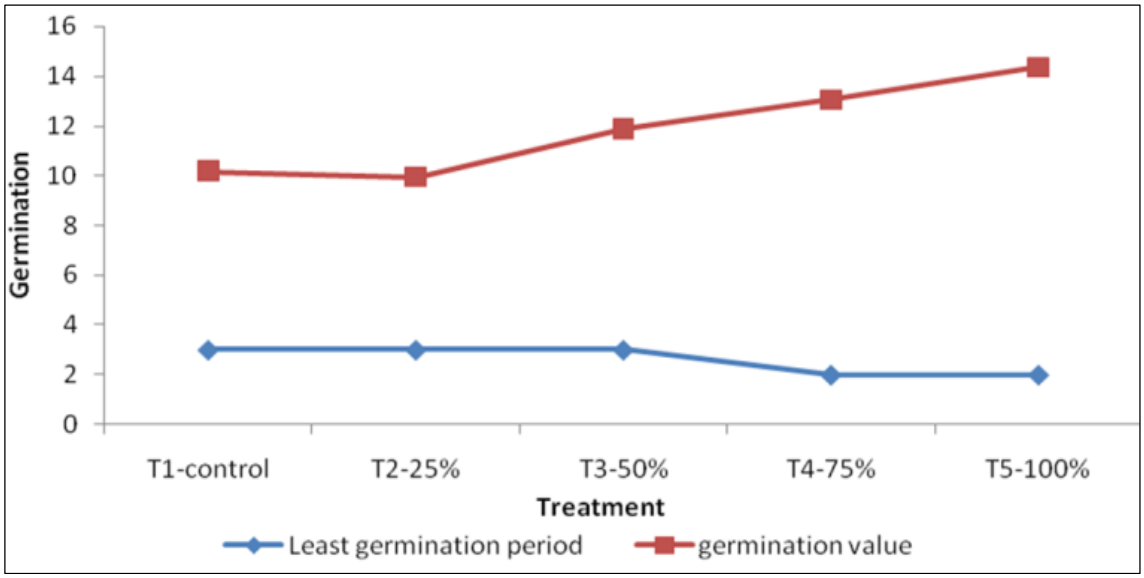

Fig 5: Effect of *Acacia nilotica* (L.) leaf leachate on germination period and germination value of fenugreek (greenhouse condition)

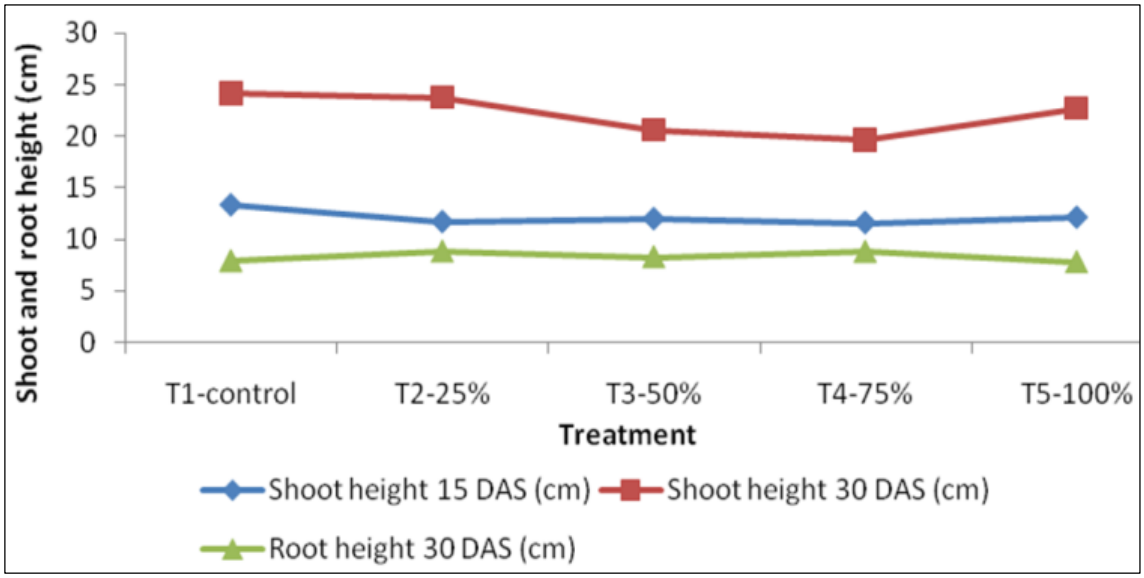

Fig 6: Effect of *Acacia nilotica* (L.) leaf leachate on shoot height of fenugreek (greenhouse condition)

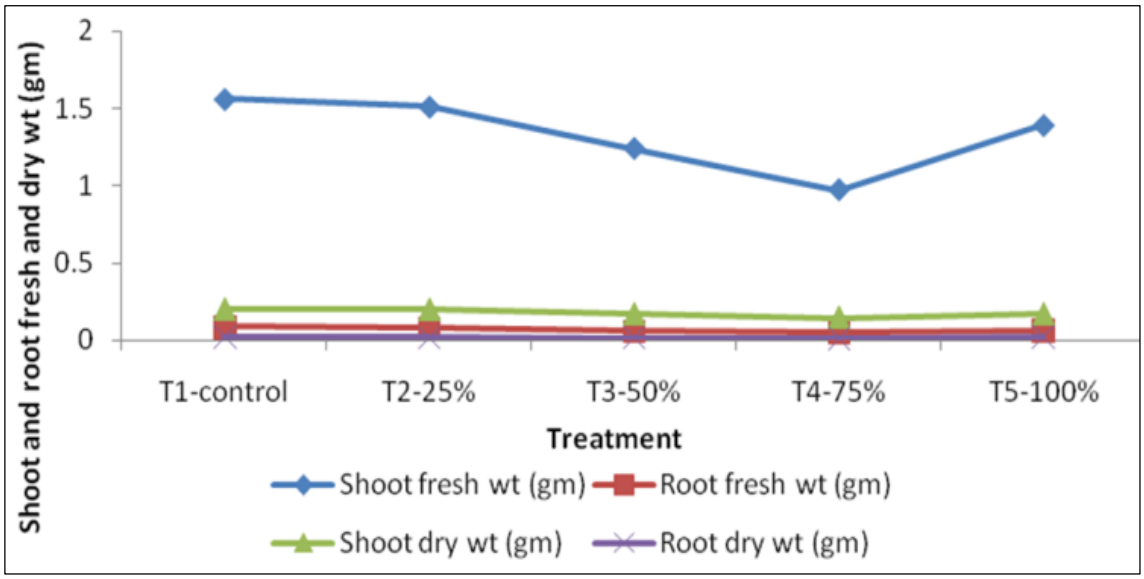

Fig 7: Effect of *Acacia nilotica* (L.) leaf leachate on shoot and root fresh and dry weight (gm) on fenugreek (greenhouse condition)

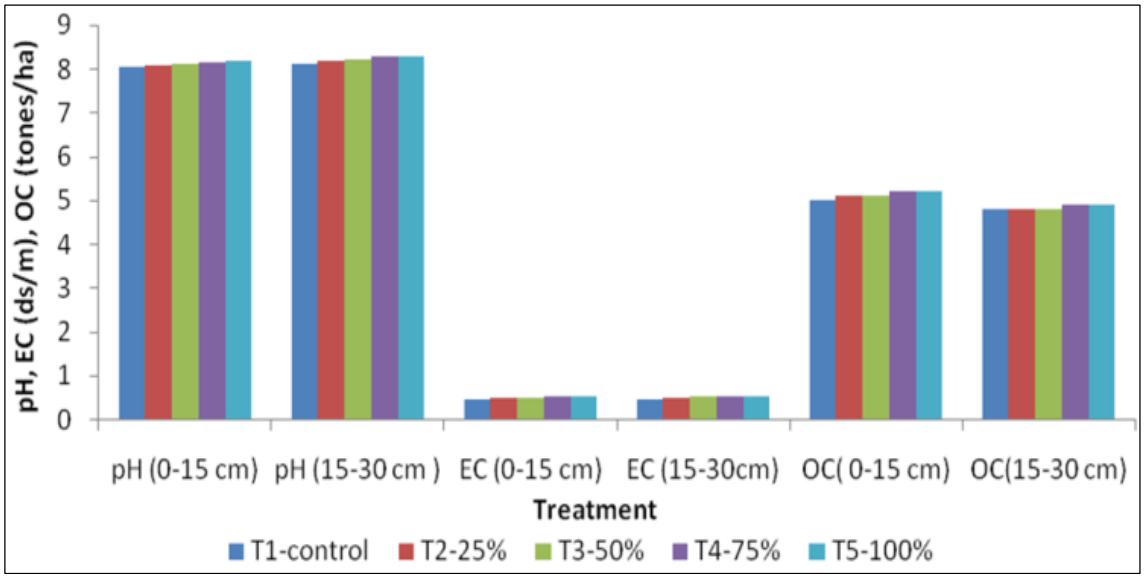

Fig 8: Effect of *Acacia nilotica* (L.) leaf leachate pH, EC, OC of soil

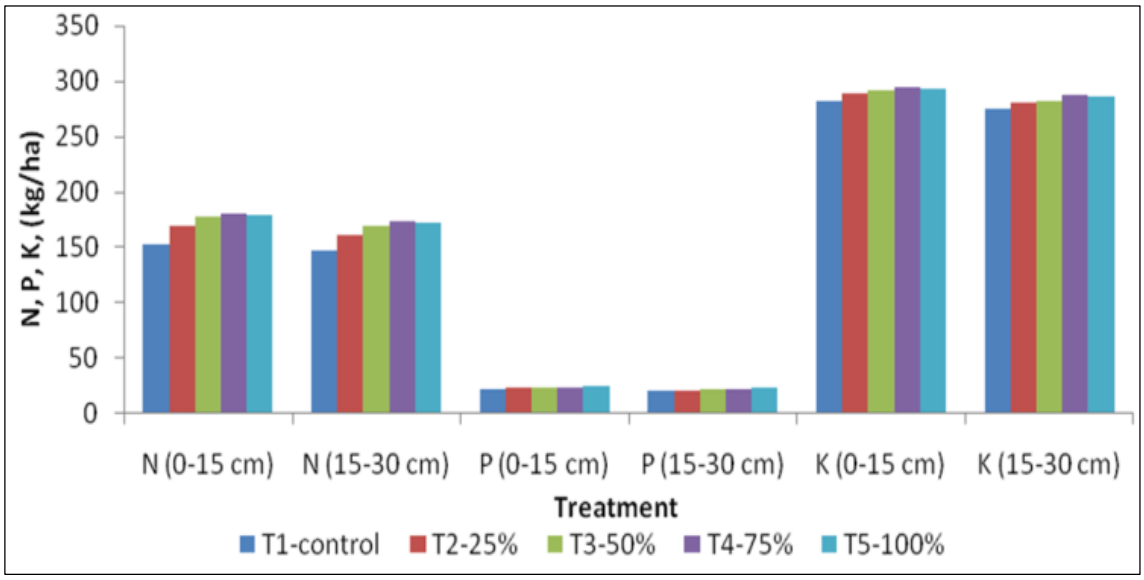

Fig 9: Effect of *Acacia nilotica* (L.) leaf leachate N, P, K of soil

Conclusion

Maximum inhibition in germination had recorded at higher concentration i.e. 75% and 100% concentration. The germination period test crop was not affected notably by different concentration of leaf leachate. But in germination value gets increases as increasing concentration. plumule length and radical length showed that, the higher concentration of *Acacia nilotica* (L.) leaf leachate had inhibitory effect on this test crop. Similarly, with respect to shoot height, the maximum height was observed at T1 (control condition) in fenugreek. The observation recorded for root height parameter revealed that the treatment in case of fenugreek the maximum positive effect was observed as the concentration increase shoot height of fenugreek also increases it also gives at par results. Negative effect on shoot and root fresh weight was recorded non-significant by showing at par result for different concentration of leaf leachates. With respect to shoot and root dry weight, inhibitory effect was marked for this crop. *Acacia nilotica* (L.) leaf leachate had neutral effect on fenugreek and it increases with increase in concentration. The improvement in soil fertility parameters was observed in soil used to grow this test crops.

References

1. Ahmed W, Orner RM, Chaudhary GM, Farooq A, Faisal CM. Effect of scattered tress of *Dalbergia sissoo* and *Acacia nilotica* on the yield of cotton crop in southern Punjab. Pak. J Agri. Sci., 2003, 40(3-4).
2. Al-Wakeel SAM, Gabr MA, Hamid AA, Abu-El-Soud WM. Allelopathic effects of *Acacia nilotica* leaf residue on *Pisum sativum* L. Allelopathy Journal. 2007; 19(2):411-422.
3. Bargali K, Bargali SS. *Acacia nilotica*: a multipurpose leguminous plant. Nature and Science. 2009; 7(4):11-19. ISSN 1545-0740.
4. Bhatt BP, Chauhan DS. Allelopathic effects of Quercus spp. on crops of Garhwal Himalaya. Allelopathy J. 2000; 7(2):265-272.
5. Champion HG, Seth SK, Khattak GM. Forest type of Pakistan, Pakistan Forest Institute, Peshawhar, 1965.
6. Channal HT, Kurdikeri MB, Hunshal CS. Sarangamath PA, Patil SA. Allelopathic influence of tree leaf extracts on green gram and pigeon pea. Karnataka Journal of Agricultural Sci. 2002; 15(2):375-378.
7. Chupitho. Allelopathic effects of multipurpose tree species *Melia azedarach* L. on vegetable crops. Dr.

Panjabrao Deshmukh Krishi Vidyapeeth, Akola. M.Sc. (unpublished), 2016, 24.
8. Dalvi VV, Pawar PR, More SS, Shigwan AS. Effect of different nitrogen fixing tree species on soil chemical properties and primary nutrient in laterite soil. Indian J of Agroforestry. 2015; 17(2):31-35.
9. Deshmukh PW. Training programme on testing of soil, irrigation water and plant. Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, 2013, 10-24.
10. Dhanai CS, Bharsakle L, Singh C. Effect of leaves extract of *Acacia nilotica* L. on the seed germination and seedling vigour of four common agriculture crop. Indian J of Agroforestry. 2014; 16(2):81-85.
11. Dhillon GPS, Dhanda RS, Dhillon MS. Performance of Wheat under Scattered Trees of Kikar (*Acacia nilotica*) under Rain fed Condition in Punjab (India) Indian Forester Journal. 1998; 124(1):48-53.
12. Einherllig FA. Interaction involving allelopathy in cropping systems. Agronomy Journal. 1996; 88:886-893.
13. Molisch H. Enfluss einer pflanze auf die Andere-Alleopathic. Fisher, Jena, Germany. 1937; 31:12-16.
14. Nair PKR. An introduction to forestry. Kluwer academic Publisher. Dordrecht, the Netherlands, 1993, 499.
15. Narwal SS. Alleopathy in agroforestry. In: Agroforestry-tradition and innovations. (Eds. Pratap Narain KS, Dadhwal, Singh RK). ICAR-UNDP Advance centre on Agroforestry Central Soil and Water Conservation Research and Training Institute Dehradun, RK, 159-169.
16. National Academy of Science. Firewood crop; shrub and tree species for energy production. Washington DC, USA, 1980, 237.
17. OPSTAT, Sheoran Programmer, Computer Section, CCS HAU, Hisar. www.google.com.
18. Rice EL. Allelopathy. 2 Editions. Orlando FL. Academic Press, 1984, 353-422.
19. Rizvi, S.J.H. and Rizvi V., 1992. Allelopathy: Basic and Applied Aspects. Chapman and Hall, London.
20. Sharma KK. Wheat cultivation in association with *Acacia nilotica* (L.) Wild ex. Del. field bund plantation: A case study. Agroforestry Systems. 1992; 17(1):43-51.
21. Swaminathan C, Rai RSV. Allelopathic proclivities of *Acacia nilotica* (L.) Wild. Ex Del. Journal of Tropical Forest Science. 1989; 2(1):56-60.
22. Swarup V. Vegetable science and technology in India. New Delhi. (Eds. Mrs. Usha Raj Kumar). Kalyani Publishers, 2006, 562-564, 568-572.
23. Thakur M. Studies on the allelopathic effects of some agroforestry tree species on soybean, Agroforestry System. International Journal of Farm Science. 2014; 4(2):107-113.
24. Tripathi VD, Prasad R, Singh P, Handa AK, Alam B, Singh R. Allelopathic effect of *Butea monosperma* L. leaf extract on seed germination and seedling vigour of selected summer legume crops. Indian J of Agroforestry. 2015; 17(2):76-81.