Al-Mukhtar Journal of Agricultural, Veterinary and Environmental Science 3 (1): 8-14, 2025
Doi: https://doi.org/10.54172/8scd6863

Research Article **Open Access**

Effect of Previous Crop Residues on Growth and Development of Squash Plants

Sami A. Alasheebi[1*], Idress A. Al Gehani[2] and Taher M. Mohammed [2]

[1]Department of Horticulture, Faculty of Agriculture, University of Benghazi, Benghazi, Libya.

[2]Department of Plant Production, Faculty of Agriculture, University of Benghazi, Benghazi, Libya.

*Corresponding author: **idress.algehani@uob.edu.ly** Department of Horticulture, Faculty of Agriculture, University of Benghazi, Benghazi, Libya.

Received: 19.05.2024
Accepted: 30.04.2025
Publish online: 31.04.2025

Abstract

The seedlings of Squash (*Cucurbita pepo* L.) were irrigated with aqueous extract of crop residues of barley or wheat or oat, at a concentration of 50 $g.L^{-1}$, or olives at 25, 50, 75 and 100 $g.L^{-1}$, in addition to the control treatment (tap water) until the flowering stage. A completely randomized design was used with the treatments. The results showed that the fresh and dry weight of the shoots decreased by (27, 26, 33%) and (26, 35, 44%), and the number of leaves and flower buds (20, 20, 25%) and (28, 24, 40%) and leaf petiole length (38, 41, 47%), when treated with aqueous extract of the residues of each of barley, wheat, or oats, respectively, compared to the control. The results also showed the effect of the aqueous extract of olive residues on the growth measurements of squash plants, and the rate of decrease was directly proportional to the increase in the concentration of the aqueous extract, and thus both the fresh and dry weight of the shoots decreased by 51% and 42%, roots 43% and 25%, plant length 40%, number of leaves 29%, and leaf area 70%, respectively, compared to the control. The results obtained show that the aqueous extract of different plant residues have a clear role in reducing the growth of squash plants, and thus, this will be reflected in productivity later. This type of effect is clearly due to the presence of an "allelopathic" effect from growth-inhibiting substances present in the tissues of previous plant residues or their presence simultaneously with squash plants in the field.

Keywords: Allelopathic; *Cucurbita pepo* L.; Squash; Aqueous extract; Crop residues, Olive residues

تأثير متبقيات المحاصيل السابقة على نمو وتطور نبات الكوسا

المستخلص: تم ري شتلات الكوسا (***Cucurbita pepo* L.**) بالمستخلص المائي لبقايا محاصيل الشعير أو القمح أو الشوفان بتركيز 50 جم/لتر أو الزيتون بتركيز 25، 50، 75 و100 جم/لتر بالإضافة إلى معاملة المقارنة (ماء الصنبور) حتى الوصول إلى مرحلة التزهير، وقد استُخدم تصميم عشوائي كامل مع المعاملات، وأظهرت النتائج انخفاضاً في الوزن الرطب والجاف للمجموع الخضري بنسبة (27، 26، 33%) و(26، 35، 44%)، وعدد الأوراق والبراعم الزهرية (20، 20، 25%) و(28، 24، 25%، 40%) وطول سويقات الورقة (38، 41، 47%)، عند معاملتها بالمستخلص المائي لبقايا كل من الشعير، القمح، أو الشوفان على التوالي، مقارنة مع معاملة المقارنة، كما أظهرت النتائج تأثير المستخلص المائي لبقايا الزيتون على قياسات نمو نباتات الكوسا وكان معدل النقصان يتناسب طرديا مع زيادة تركيز المستخلص المائي وكذلك الوزن الطازج والجاف للنبات، وانخفض معدل النمو الخضري بنسبة 51% و42%، والجذور 43% و25%، وطول النبات 40% وعدد الأوراق 29% والمساحة الورقية 70% على التوالي نسبة لمعاملة المقارنة، وأوضحت النتائج المتحصل عليها أن المستخلص المائي لمخلفات النباتات المختلفة له دور واضح في تقليل نمو نباتات الكوسا وذلك سينعكس على الإنتاجية لاحقاً، ومن الواضح أن هذا النوع من التأثير يرجع إلى وجود تأثير "اليلوباثي" من المواد المثبطة للنمو الموجودة في أنسجة بقايا النباتات السابقة أو وجودها بالتزامن مع نباتات الكوسا النامية في الحقل.

الكلمات المفتاحية: اليلوباثي، الكوسا، *Cucurbita pepo* L.، بقايا المحاصيل، بقايا الزيتون مستخلص مائي.

الباحث الاول[1]*: سلوى الفزاني، ،باطنة والأمراض المعدية، كلية الطب البيطري، ليبيا.
الباحث الثاني: رضية مصطفى، الطب الوقائي، كلية الطب البيطري، ليبيا
الباحث الثالث: محمد الجدر، علم الأحياء الدقيقة وعلم الطفيليات كلية الطب البيطري، ليبيا.
الباحث الرابع: نوارة بلقاسم، الأمراض السريرية البيطرية والطبية والمعدية، كلية الطب البيطري، ليبيا.

INTRODUCTION

The cultivation of field crops such as wheat, barley, and oat are widespread during the winter season in vast areas of arable land. Despite the great benefit and significant profit from production, the possibility of investing some of these areas in cultivating summer crops faces some obstacles. The process of preparing the land for agriculture, which includes the process of cleaning it from the remains of the previous crop, will not be easy and will not be achieved completely, and it may be impossible to get rid of the roots, stems, and even grains left behind by plants. Also, the presence of plant remains is not limited to what is left behind by field crops only, but it may also come from fallen leaves from cultivated trees, such as olives and others, and this cannot be avoided when wanting to exploit the interstitial spaces by planting some other crops.

The presence of these plant remains and their decomposition in the lands targeted for cultivation is greatly beneficial in improving the properties of the soil and increasing its fertility, and thus this is reflected in increased production. However, in many cases this may lead to a negative impact on the productivity of the next crop due to the plant remains containing substances that hinder growth and the natural development of some plant species, which is known as the "allelopathic" effect. It is recognized that plants compete with each other in various aspects of their lives, such as moisture, nutrients, and light, directly or through the influence that is common in nature, which is an inhibitor of the growth of other plants (Tanveer *et al*., 2010). The inhibitory effect of one plant on the growth of another plant appears through the ability of one plant to release allelopathic chemicals that inhibit the growth of other plants (Abu Rumman, 2016; Kluth *et al.*, 2018). Allelopathic compounds are formed and accumulated in all parts of the plant, roots, stem, rhizome, leaves, fruits, and seeds (Vijayan, 2015). But the leaves are considered the most important parts of the plant in accumulating at the highest level (Kumari *et al.*, 2016). Allelopathic compounds come into contact with other competing plants by filtering decomposing plant residues, root filtration, volatilization, as well as some other processes (Sikolia & Ayuma, 2018). Indeed, Zuo *et al.,* (2005) found that the aqueous extract of a group of wheat varieties reduced the length of the root system of lettuce plants at several stages of the plant's life. As much, wheat plant residues reduced the dry weight of the root and shoot of oat plants (Mahmood *et al.*, 2013). Also, Ashrafi *et al.* (2007) found that aqueous extracts of barley reduced the germination rate, the length and weight of the upper embryonic stalk, and the length and weight of the radicle of (*H. spontaneum*). While that, Ben-Hammouda *et al.,* (2001) indicated that aqueous extracts of barley reduced root and seedling growth for several wheat varieties. On the other hand, Shao *et al.*, (2019) found that the aqueous extract of oat plants reduced the germination rate, and also decreased shoot length and root length of wheat plants. In addition to those high concentrations of 50% and 100% oat aqueous extract reduced the germination rate, the dry weight of the shoot and root system, the plant height, and the number of leaves of cucumber plants (Wang *et al.*, 2010). On the other hand, Tubeieh & Souikane (2020) found that aqueous extract of olive tree residues reduced the rate and speed of germination of four types of weeds. Orr *et al.*, (2005) also found that olive leaf extract reduced the germination rate and biomass of roots and leaves of some forest trees. As well as, the waste of olive presses reduced the length of the shoot and root and their fresh and dry weight, and the content of the shoot of sugars and proteins decreased (Saleh, 2013). Popolizio *et al.*, (2022) added that the waste of olive presses reduced the rate and speed of germination of tomato plants. After that, Endeshow *et al.*, (2015) pointed out that adding olive branch residue to the growth environment of olive seedlings reduced the dry weight of the shoot, the length of the seedling, and the dry weight of the root shoot. It also reduced the shoot to root ratio, and the content of the leaves and roots of nitrogen and phosphorus was also reduced. Moreover, Zairi *et al*. (2020) found that the germination rate of wheat and flax plants showed a gradual decrease with the increase of all concentrations of aqueous extracts of olives. In addition to that, Al-Samarai *et al.*, (2018) found that irrigation with olive leaf extracts reduced the germination rate and growth of hops. As for squash plant, it was allelopathically affected by extracts of forest trees (Eucalyptus and Acacia), so the germination rate and speed decreased, the fresh and dry weight of the plant decreased, and the number of leaves and flower buds of the plant decreased (Alasheebi *et al.*, 2021). El-shora and Abd El-Gawad (2015) also found that the extract of the purslane plant, (*Portulaca oleracea* L.), reduced the germination rate of squash plants, and the leaf content of protein, chlorophyll b, a, and total decreased, while the percentage of proline increased. The allelopathic effect is clearly achieved between the remains of dead plants and developing plants, and it also commonly occurs between growing and neighboring plant species, and thus plants are affected by the appearance of symptoms of general weakness represented by lack of growth and impaired development. Therefore, growing summer Squash (*Cucurbita pepo* L.) often on lands previously planted with winter crops or in the spaces between fruit trees makes it highly exposed to the influence of the remains of previous or neighboring plants. Given the importance of the squash crop, it is necessary to investigate the problems that hinder its growth and increase its production. Therefore, this research will focus on the extent to which the residues of some field crops and trees affect the growth and development parameters of the squash plant.

MATERIALS AND METHODS

Plant material and growth conditions: The experiment was carried out at the research station of the Faculty of Agriculture - University of Benghazi – Libya, during the summer seasons of 2022 and 2023. The study began by planting two-week-old squash (*Cucurbita pepo* L. Alex-andria F1) seedlings in a culture medium (soil, sand, and peat moss in volume ratios 1:1:1) in 3-liter of plastic pots. Throughout the experiment, the plants were fertilized by mixing modified Hoagland Solution as a complete nutrient solution (NS) with irrigation water. The full NS contains (in m mol. L^{-1}) 5 KNO_3, 5 Ca $(NO_3)_2{\cdot}4H_2O$, 2 $MgSO_4{\cdot}7H_2O$, 1 KH_2PO_4, 0.02 $FeSO_4{\cdot}7\ H_2O$; 0.02 Na_2- EDTA; 2 H_2O; 0.045 H_3BO_3; 0.01 $MnCl_2{\cdot}4\ H_2O$, and (in µmol/L) 0.8 $ZnSO_4{\cdot}7\ H_2O$, 0.4 $Na_2MoO_4{\cdot}2\ H_2O$, and 0.3 $CuSO_4{\cdot}5\ H_2O$. Plants were grown under a plastic cover for protection from rain at 14h photo-period. Photosynthetic active radiation reached a daytime peak value of 1250 µmol.m^{-2}. s^{-1}, and the temperature and relative humidity were 31 and 19°C and 41 and 80% during the day and night periods respectively. Irrigation was scheduled according to plant requirements and the substrate water holding field capacity. The aqueous extract concentrations were prepared by first grounding the dry leaves of each barley or wheat or oat, as well as olives, then soaking certain weights in fresh water according to the required concentrations for 24 hours at room temperature, and second, the extract was filtered and used immediately under field conditions for irrigation.

Treatments: The plants were irrigated with aqueous extract of crop residues of each barley or wheat or oat, at a concentration of 50 g.L^{-1}, or olives at concentrations of 25, 50, 75 and 100 g.L^{-1}, in addition to the control treatment (tap water only) until the flowering stage was reached.

Measurements: The measurements were effectuated after three weeks from planting, fresh weight (FW) of shoot and root were measured, then plants were dried for three days in an oven at 65 °C (until there was no decrease in weight) for determination of dry weight (DW) of shoot and root, the percentage of water content (WC) was also measured. The number of flower buds and leaves were counted, the height of plant and length of petioles, as well as leaf area was also estimated by the correlation between leaf area and leaf fresh weight (Watson, 1937).

Experimental design and statistical analysis: The data represent averages for two separate experiments. Each treatment was replicated six times, where each pot is considered a one replicate, and by a plant in each pot. The first experiment consists of one factor with 4 levels of aqueous extract types (wheat, barley and oat extract as well as control) at a concentration of 50 $g.L^{-1}$. The second experiment consisted of one factor with 5 levels representing the concentrations of leaf aqueous extract of olive (0, 100, 75, 50, 25) $g.L^{-1}$. A completely randomized design was used with the treatments. The data were subjected to a one-way analysis of variance and the means were compared using the least significant difference test (LSD) at 5% significance level.

RESULTS

The results in table 1. showed a significant decrease in the fresh weight (FW) and dry weight (DW) of the shoots of squash plants when irrigated with aqueous extracts of field crop residues (barley, wheat, oat), where the largest percentage of decrease was recorded from treatment with oat extract at a rate of 33 and 44%, while the percentages of decrease were recorded when treated with barley and wheat extracts, 27 and 26%, 26, and 35%, respectively, compared to the control treatment. Irrigation with aqueous extracts of crop residues also had a significant effect on the number of plant leaves, decreasing by 20 to 25% compared to the control treatment. The number of flower buds and leaf petiole length also decreased significantly, and the largest decrease values were attributed to oat extract by 40 and 47%, respectively, while the percentages decreased to 28 and 38%, respectively, when irrigated with barley extract, and 24 and 41% when irrigated with wheat extract, respectively. On the other hand, irrigation with aqueous extracts of field crop residues did not significantly affect the water content (WC) of squash plants.

Table:(1). Effect of aqueous extract of some crop residues (50 g.L-1) on some growth measurements of squash plants.

Types of aqueous extract	Shoot FW (g)	Red. (%)	Shoot DW (g)	Red. (%)	Leaf No.	Red. (%)	Flower buds No.	Red. (%)	Leaf petiole length (cm)	Red. (%)	WC (%)	Red. (%)
Control	7.7[a]	-	0.87[a]	-	5.0[a]	-	6.1[a]	-	11.5[a]	-	90	-
Barley	5.6[b]	**27**	0.64[b]	**26**	4.0[b]	**20**	4.4[b]	**28**	7.1[b]	**38**	88	**1**
Wheat	5.7[b]	**26**	0.56[b]	**35**	4.0[b]	**20**	4.6[b]	**24**	6.8[b]	**41**	90	**0**
Oat	5.1[c]	**33**	0.48[c]	**44**	3.8[b]	**25**	3.6[c]	**40**	6.1[c]	**47**	90	**0**
LSD	*0.45*	-	*0.11*	-	*0.38*	-	*0.71*	-	*0.62*	-	*N.S*	-

Each value represents mean of six replicates. Means followed by the same letter in each column are not significantly different by least significant difference (LSD) test at 5% level.
FW: fresh weight; DW: dry weight.
Red. (%): attributable reduction percent to control value.

The results presented in table 2. showed that the growth of squash plants was affected when irrigated with aqueous extracts of olive leaves at different concentrations. The fresh weight of the shoot (FW) and root (DW) decreased significantly compared to the control treatment, and the decrease was directly proportional to the increase in the concentration of the aqueous extracts (25, 50, 75, and 100 $g.L^{-1}$), with decrease rates of 29, 47, 47 and 51%, and 23, 42, 42 and 42%, respectively. The FW of the roots also decreased directly with increasing concentration of aqueous extracts, with decreases of 17, 22, 39 and 43%. The DW of the roots also decreased significantly by 25% for all concentrations compared to the control treatment. Also, aqueous extracts of olive leaves had a direct effect on reducing plant height with increasing concentrations of the extracts. The lowest values were with the treatment with the highest concentration (100 $g.L^{-1}$), at a rate of 41%, while the rest of the treatments led to a decrease of 25, 27 and 28%, respectively. The number of leaves also decreased significantly as a result of irrigation with aqueous extracts of olive leaves, and the percentages of decrease were 12, 14, 29 and 29%, respectively. The leaf area of the plant also decreased significantly and in a direct pattern with increasing concentration of extracts, with percentages of decrease of 31, 52, 61 and 70%, respectively. On the other hand, the water content (WC) of the plant was not significantly affected by irrigation with aqueous extracts of olive leaves.

Table:(1). Effect of aqueous extract concentrations of olive tree residues on some growth measurements of squash plants.

Aqueous extract Con. ($g.L^{-1}$)	Shoot FW (g)	Red. (%)	Shoot DW (g)	Red. (%)	Root FW (g)	Red. (%)	Root DW (g)	Red. (%)	Plant height (cm)	Red. (%)	Leaf No.	Red. (%)	Leaf area (cm^2)	Red. (%)	WC (%)	Red. (%)
Control	19.5[a]	-	2.6[a]	-	2.3[a]	-	0.39[a]	-	17.6[a]	-	5.8[a]	-	62.7[a]	-	86	-
25	13.8[b]	**29**	2.0[b]	**23**	1.9[ab]	**17**	0.29[b]	**25**	13.2[b]	**25**	5.1[ab]	**12**	43.4[b]	**31**	85	**1**
50	10.3[c]	**47**	1.5[c]	**42**	1.8[bc]	**22**	0.30[b]	**25**	12.8[b]	**27**	5.0[b]	**14**	30.3[c]	**52**	85	**1**
75	10.3[c]	**47**	1.5[c]	**42**	1.4[cd]	**39**	0.30[b]	**25**	12.7[b]	**28**	4.1[c]	**29**	24.6[cd]	**61**	85	**1**
100	9.5[c]	**51**	1.5[c]	**42**	1.3[d]	**43**	0.29[b]	**25**	10.4[c]	**41**	4.1[c]	**29**	18.7[d]	**70**	84	**2**
LSD	*3.12*	**-**	*0.39*	**-**	*0.40*	**-**	*0.08*	**-**	*2.20*	**-**	*0.65*	**-**	*10.1*	**-**	*N.S*	**-**

Each value represents mean of six replicates. Means followed by the same letter in each column are not significantly different by least significant difference (LSD) test at 5% level.
FW: fresh weight; DW: dry weight.
Red. (%): attributable reduction percent to control value.\

DISCUSSION

Aqueous extracts of field crop residues (barley, wheat, and oat) had a negative effect on the growth of squash plants, which led to a decrease in the FW and DW values of the shoot and root system. It also led to a decrease in the number of leaves, the length of leaf petioles, and the number of flower buds. Our result is consistent with findings of many studies (Zuo *et al.*, 2005; Ashrafi *et al.*, 2007; Wang *et al.*, 2010; Mahmood *et al.*, 2013) that's where the effect of barley, wheat and oat residues has been clearly manifested. It has a negative effect on plant growth resulting from the secretion of dissolved chemicals that inhibit growth (allelopathic effect). In addition, it may contribute to raising the osmotic pressure of the soil solution, which makes it difficult for the plant to absorb water. These materials may also raise the pH value of the soil and thus make it difficult for some nutrients availability. This condition leads to a deficiency in the plant growth and reflects negatively on the efficiency of the photosynthesis process, subsequently leads to weak plant growth. This leads to stunted growth of the plant, small size and small number of leaves, and thus poor fruit production of the plant. The most negative allelopathic effect was for the aqueous extract of oats, as it gave the lowest values for plant growth measurements. While the barley plant extract had the least effect on plant growth than the other aqueous extracts, although there were significant differences between the barley extract treatment and the control. As for the aqueous extract of the wheat plant, its inhibitory effect was intermediate between the effect of the aqueous extract treatments of barley and oat. Also, the allelopathic effect of olive leaf residues negatively affected the growth of squash plants, which led to a significant decrease in the FW and DW of both the shoot and root system, and a significant decrease in the length of the plant, the number of leaves, and the leaf area of the plant compared to the control treatment. This is confirmed by several studies on the effect of olive leaf residues (Orr *et al.*, 2005; Endeshow *et al.*, 2015; Al-Samarai *et al.*, 2018), as the negative impact of the allelopathic effect on plant growth increased with increasing concentration of aqueous extracts, which was mentioned by Zairi *et al.*, (2020). The reason may be that the concentration of growth inhibitory substances increases with the concentration of aqueous extracts. In addition to increasing the osmotic pressure of the soil solution and affecting the soil pH, which causes difficulty in absorbing water and nutrients necessary for plant growth (Endeshow *et al.*, 2015). It will certainly affect the efficiency of the photosynthesis process and thus reduce the plant's content of the essential compounds needed for growth. In addition, the level of sugars and proteins is affected, which leads to a general weakness in plant growth and a decrease in dry matter synthesis (Saleh, 2013). In addition to was mentioned above, a decrease in leaf area and the number of leaves per plant means a decrease in the area and efficiency of the plant, which appears in the form of stunting, weak plant growth, and decreased dry matter formation. This certainly leads to poor flowering and fruiting development of the plant and thus a quantitative and qualitative decline in p

CONCLUSION

The allelopathic effect of aqueous extracts of barley or wheat or oat leaves on the one hand and of olive leaves on the other hand on the growth of squash depends on the type of plant affected and the concentration of its aqueous extract. The growth parameters of squash plants were clearly affected after irrigation with different water extracts. The effect greatly weakened plant growth, especially when treated with oat residue, while the effect was less severe with barley and wheat residue. On the other hand, the decrease in plant growth is directly proportional to the increase in the concentration of the aqueous extract of olive leaves.

ACKNOWLEDGEMENT

We thank our colleagues for assistance in the field and laboratory. Thanks to all the technicians for preparing the samples.

REFERENCES

Abu-Romman, S. (2016). Differential allelopathic expression of different plant parts of *Achillea biebersteinii*. *Acta Biologica Hungarica*, 67(2): 159-168.

Alasheebi, S. A., Al Gehani, I. A., & Mohammed, T. M. (2021). Effect of Aqueous Extract of some Windbreak Tree Leaves on Seed Germina-tion and Seedling Growth of Squash. *Al-Mukhtar Journal of Sciences*, 36(3): 223-230.

Al-Samarai, G. F., Mahdi, W. M., & Al-Hilali, B. M. (2018). Reducing environmental pollution by chemical herbicides using natural plant derivatives–allelopathy effect. *Ann. Agric. Environ. Med.*, 25(3): 449-452.

Ashrafi, Z. Y., Sadeghi, S., &Mashhadi, H. R. (2007). Allelopathic effects of barley (Hordeumvulgare) on germination and growth of wild barley. *Pak J Weed Sci Res.*, 13(1-2): 99-112.

Ben-Hammouda, M., Ghorbal, H., Kremer, R., &Oueslati, O. (2001). Allelopathic effects of barley extracts on germination and seedlings growth of bread and durum wheats. *Agronomie*, 21(1): 65-71.

El-Shora, H. M., & El-Gawad, A. M. A. (2015). Physiological and biochemical responses of Cucurbitapepo L. mediated by Portulacaoleracea L. allelopathy. *Fresenius Environmental Bulletin*, 24(1b): 386-393.

Endeshaw, S. T., Lodolini, E. M., &Neri, D. (2015). Effects of olive shoot residues on shoot and root growth of potted olive plantlets. *ScientiaHorticulturae*, 182: 31-40.

Kluthe, B., Ali, M., & Stephenson, S. (2018). Allelopathic influence of Eucalyptus on common Kenyan agricultural crops. *J AgronAgric Sci.*, 1(1): 2-6.

Kumari, N., Srivastava, P., Mehta, S., & Das, B. (2016). Allelopathic effects of some promising agro forestry tree species on different annual crops. *Eco. Env. & Cons.*, 22(1): 225-236.

Mahmood, K., Khaliq, A., Cheema, Z. A., &Arshad, M. (2013). Allelopathic activity of Pakistani wheat genotypes against wild oat (*Avenafatua* L.). *Pak. J. Agri. Sci.*, 50(2): 169-176.

Orr, S. P., Rudgers, J. A., & Clay, K. (2005). Invasive plants can inhibit native tree seedlings: testing potential allelopathic mechanisms. Plant Ecology, 181, 153-165.

Popolizio, S., Fracchiolla, M., Leoni, B., Cazzato, E., & Camposeo, S. (2022). Phytotoxic Effects of Retentates Extracted from Olive Mill Wastewater Suggest a Path for Bioherbicide Development. *Agronomy*, 12(6): 1378.

Saleh, A. M. (2013). In vitro assessment of allelopathic potential of olive processing waste on maize (*Zea mays* L.). *Egypt. J. Exp. Biol*, 9(1): 35-39.

Shao, Q., Li, W., Yan, S., Zhang, C. O. N. G. Y. U., Huang, S., &Ren, L. (2019). Allelopathic effects of different weed extracts on seed germination and seedling growth of wheat. *Pakistan journal of botany*, 51(6): 2159-2167.

Sikolia, S. F., & Ayuma, E. (2018). Allelopathic effects of *Eucalyptus saligna* on germination growth and development of *Vigna Unguiculata* L. Walp. *IOSR Journals*, 12(3): 15-24.

Tanveer, A., Rehman, A., Javaid, M. M., Abbas, R. N., Sibtain, M., Ahmad, A. U. H., Ibin-I-Zamir, M. S., Chaudhary, K., & Aziz, A. (2010). Allelopathic potential of *Euphorbia helioscopia* L. against wheat (*Triticum aestivum* L.), chickpea (*Cicera rietinum* L.) and lentil (*Lens culinaris* Medic.). *Turkish Journal of Agriculture and Forestry*, 34(1): 75-81.

Tubeileh, A. M., & Souikane, R. T. (2020). Effect of olive vegetation water and compost extracts on seed germination of four weed species. *Current plant biology*, 22: 100-150.

Vijayan, V. (2015). Evaluation for allelopathic impact of *Acacia auriculiformis A. Cunn.* ex Benth on Seed germination and Seedling growth of Rice (*Oryza sativa* L), a widely cultivated Indian crop species. *Research Journal of Agriculture and Forestry Sciences* -ISSN, 2320, 6063.

Wang, Y., Wu, F., & Zhou, X. (2010). Allelopathic effects of wheat, soybean and oat residues on cucumber and Fusarium oxysporum f. spcucumerinum Owen. *Allelopathy Journal*, 25(1): 107-114.

Watson, D. J. (1937). The estimation of leaf area in field crops. *J. Agric. Sci.,* 27:474-483.

Zaïri, A., Nouir, S., Zarrouk, A., Haddad, H., Khelifa, A., &Achour, L. (2020). Phytochemical profile, cytotoxic, antioxidant, and allelopathic potentials of aqueous leaf extracts of *Olea europaea*. *Food Science & Nutrition*, 8(9): 4805-4813.

Zuo, S. P., Ma, Y., Deng, X. P., & Li, X. W. (2005). Allelopathy in wheat genotypes during the germination and seedling stages. *Allelopathy Journal*, 15(1): 21-30.