Bull. Fac. Agric., CairoUniv., 71:279 -288(2020).

PRELIMINARY STUDY ON GERMINABLE SUMMER WEED SEED BANK AT GIZA FARM RESEARCH STATION, AGRICULTURAL RESEARCH CENTER, EGYPT

(Received: 11.10. 2020)

By
Maha F. El-Enany, Enas M. Kamel and Azza E. Khaffagy

Weed Research Central Laboratory, Agricultural Research Center, Giza, Egypt.

ABSTRACT

Despite efforts to eliminate weeds, they continue to thrive. Weed persistence is reliant upon the soil seedbank. Knowledge of the soil seedbank is continually expanding, but with the rising threat of herbicide-resistant weeds in agriculture, weed scientists have, in the past, focused their management tactics to more short-term solutions that tackle the aboveground problems, rather than long-term solutions. Uptill now, there are few studies about weed seed bank in Egypt. For this reason establishing weed seed bank studies about vertical and horizontal distribution patterns is needed for weed management in Egypt. The present study was carried out during 2018 and 2019 summer seasons to evaluate the magnitude of the non-dormant weed seed bank of summer annual weeds in five different basins in Giza research station. Weed seed germination was kept under observation for a period of six weeks and the germinated seeds were counted weekly and removed after that. The results indicated that most of weed seeds were concentrated in the above 0-5 cm layer followed by 5-10 cm layer and the least were found in 10-15cm layer from soil surface. Most of weed seeds germinated in 1^{st} and 2^{nd} weeks, and decreased gradually in the next weeks, where about 95% of weed seeds in soil profile were germinated in the first five weeks. The existed weed flora contained 15 species which differ in their richness from one basin to another. The highest number of germinated weed seeds were recorded in basin 12 (498.8 and 408.1 seedling/kg of soil) in 1^{st} and 2^{nd} seasons, respectively, while the least number of germinated weed seeds were found in basins 19 (45.7 and 64.0 seedlings/kg of soil) in 1^{st} and 2^{nd} seasons, respectively. By using ANOVA statistical analysis, experimental error decreased by taking 3-4 soil samples, to give adequate accuracy for soil seed bank determination than taking one soil sample. The relationship between number ofseedlings/m^2 and CV% was linear equations: "CV%= -0.26 × Number of seedlings + 29.53" and "CV%= -0.4 × Number of seedlings + 31.103" in the first and second summer seasons, respectively. In conclusion weed seed bank determination in soil is a key for sustainable agriculture in Egypt. The present study throws light of vertical or horizontal distributions in soil profile in seed bank as a good tool for improving weed management in cropping system in Egypt.

Keywords: *weed seed bank, CV% (Coefficient of Variation%), experimental error, soil depth.*

1. INTRODUCTION

Soil seedbanks serve as pools of genetic material that enable a range of responses to environmental conditions and buffer populations against temporary adverse environmental conditions (Teo-Sherrell *et al* .,1996). Many weed communities are regulated by the soil seedbank (Buhler *et al* ., 1997). Therefore, an understanding of soil seedbank dynamics is critical to the development of more efficient weed management, (Buhler *et al*.,1997; Kellman, 1978). Forcella *et al* (1993) postulated that, in order to reduce the chemical herbicide load to the environment, without affecting crop yield, an accurate understanding of weed ecology is necessary, including seedbank density, seed dormancy, seedling emergence, and environmental variables that regulate these factors is necessary. Khan *et al*. (2012) found that the majority of weed seeds germinated from the soil samples collected from the above 5 cm of the soil surface. Furthermore, a dense seed bank was found in above 5 cm soil profile. However, the most of weed seeds germinated in the first two weeks of the experiment. The seed bank is like a tablet preserving in itself the plant history of the region; and to a large extent determines the future of plant populations in the region (Ball, 1992). Although it seems impossible to obtain complete information on all aspects of the seed bank and to accurately predict the weed flora by using this information, yet the composition and the densities of the species in the seed bank provides valuable information for the management of weeds. Ecological knowledge creates a perspective which makes it possible to better concentrate on a range of management operations (Forcella *et al*., 1996). Sampling field soils to determine seed bank was confined to the surface and upper 30 cm of soil. The horizontal distribution of seeds across soils, in part, relay on how many soil samples need to be taken. Weed seeds typically are not distributed randomly across a field. Weed seed bank is always highly aggregated in agriculture fields (Wiles and Schwezer, 1999; Chauvel *et al*., 1989). This basically means that many soil samples representative of seed bank for any particular species will have no seeds. For instance, Jones (1998) found at least half samples cores were devoid of the seeds when seed densities were less than 750 seeds m^{-2}. And the most common species had the highest value of seeds m^{-2} had the lowest CV. Forcella *et al*. (1993) mentioned that species with very low densities (< 100 seeds m^{-2}) would require so many soil cores for precise determination of seed bank which is not practical.

Crop rotation has long been recognized as one of the most fundamental and effective weed management tools (Garrison *et al*., 2014; Leibman *and Davis*, 2009) and Leighty,1938). Crop rotations of summer and summer annual crops can benefit weed management (Anderson, 2004). Planting and harvest date differences among crops in a rotation provide opportunities to prevent weed establishment or seed production. Gholshan and Yasari (2012) found in comparison of sampling methods for estimating seed bank, the variance of error stabilized and no more reduction of error was observed. They found that 5 samples were almost the same as those from 30 samples and reliable to a large extent and at the same time very desirable as far as the required time and money are concerned. Distribution of the weed seed bank vertically in the soil profile depends on the type of tillage and is the main factor determining the vertical distribution of weed seeds within the soil profile (Hossain and Begum, 2015). The present work depends on the use of germination method technique for enumerating seed in the soil seeds bank according to Forcella *et al*. (2003). Thus, the objective of the present study is to map the magnitude of summer seed bank horizontally in the studied basins and vertically in the soil profile in each basin and the suitable number of soil samples to determine a soil seed bank precisely in Giza research station.

2. MATERIALS AND METHODS

The present study was designed to investigate the magnitude of summer weed seeds at different soil depths at different basins of the Agricultural Research Center farm, Giza Research Station during summer seasons of 2018 and 2019 at three depths 5, 10 and 15 cm from soil surface at five scattered locations viz., centrer, north, south, east and west. The studied basins namely; 5, 6, 12, 19 and 20 as shown in Map (1).

Soil samples of the study were taken in June. Number of the studied samples in each basin was 12 samples. Four soil samples were taken randomly from each studied basin, for each depth of the three studied depths 0-5, 5-10 and 10-15 cm by auger 5 cm diameter, and four sub soil samples as one kg from each basin. Soil samples were put into plastic pots in June at the Weed Research Central Laboratory, in clay loamy soil texture as shown in Table (1), and were watered regularly as needed.

The recorded data were the number of germinated seedlings from weed seeds in each pot weekly for six weeks period. All the data for each basin were exposed to the proper statistical analysis according to the procedures outlined by Steel and Torrie, (1980), using Genstat 18*th* edition to determine ANOVA table for one, two, three and four samples from each basin to determine L.S.D., CV% (Coefficient of Variation), EE (Experiment Error) and SE (Sampling Error) to compare the variance under each number of samples to determine the suitable samples number. Correlation factor between numbers of seedlings/m^2 and CV% and regression equations were estimated.

Map (1): Map of Agricultural Research Center, Giza, Egypt.

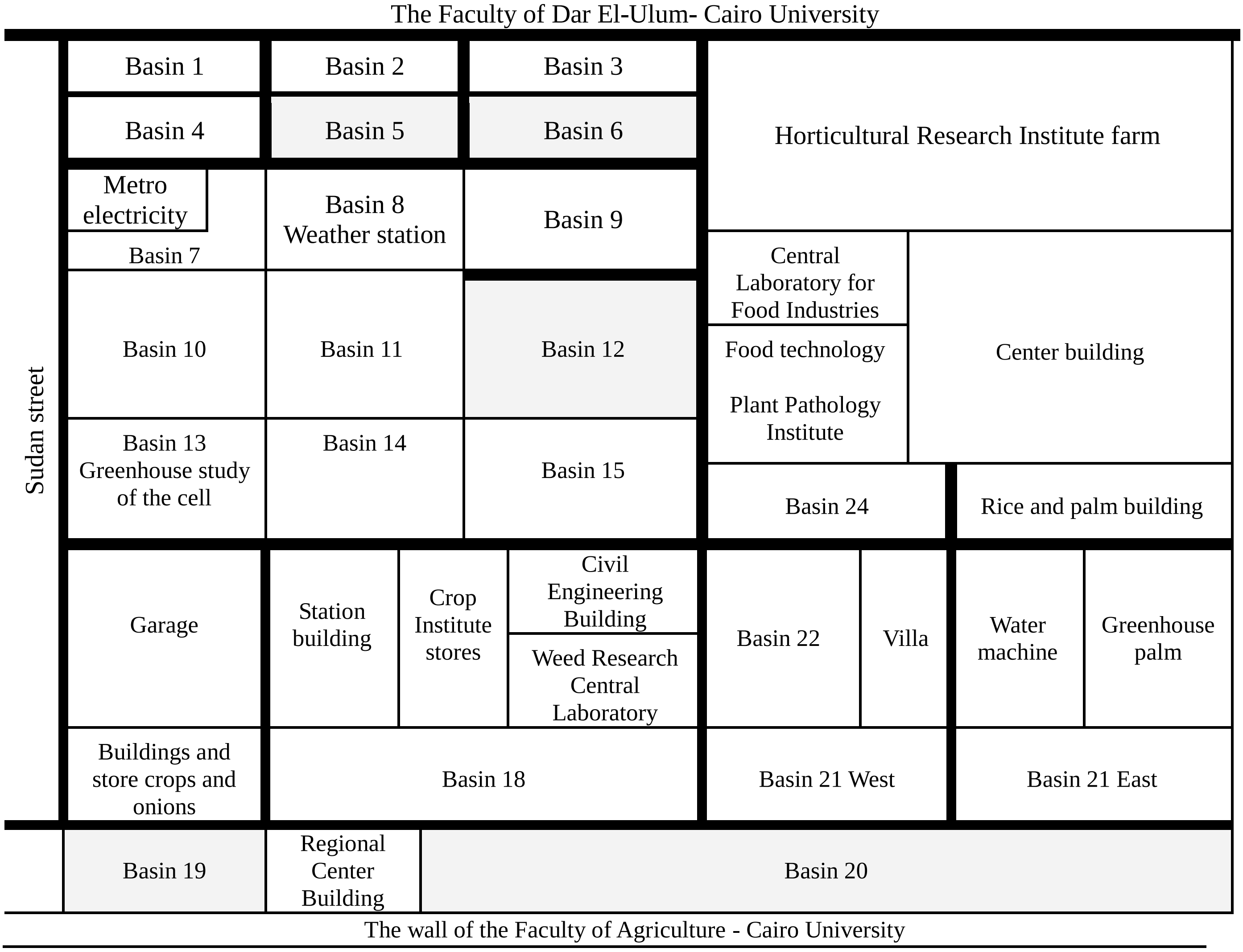

Table (1): Mechanical and chemical soil analysis at the experimental site.

Mechanical analysis %					Chemical analysis			Anions Eqm/L			Cations Eqm/L			
Basin number	Sand	Silt	Clay	Texture	SP.	PH (1: 2.5)	E.C ds/m	HCO_3^-	Cl	$SO_4^=$	Ca^{++}	Mg^{++}	Na^+	K^+
5	24.9	38.1	37	Clay loamy	48	8	6.27	1.2	8.5	1.8	3.8	1.81	5.7	0.19
6	22.6	39.8	37.6	Clay loamy	45	8.09	1.98	1.9	13.3	2.7	5.2	3.48	9	0.22
12	23.4	39.4	37.2	Clay loamy	57	8.22	1.79	1.7	11.2	2.9	4.9	2.75	8	0.15
19	21.3	39.9	38.8	Clay loamy	67	8.3	2.08	1.2	14.9	2.8	5.7	3.75	8.7	0.75
20	24.2	38.5	37.3	Clay loamy	48	8.11	2.55	2.5	18.8	3.2	7.1	4.03	12.5	0.87

Soil analysis had been done in Soil and Water Institute, Agricultural Research Center, Egypt.

3. RESULTS AND DISCUSSION

3.1. Weed species composition

Fifteen different weed species were recorded in the studied basins namely, *Convolvulus arvensis* (bindweed), *Echinchoe colonum*, *Echinochloe crus galli* (cockspur grass), *Digilaria sangunalis* (hairy crabgrass), *Corchorus olitorius* (Bush okra), *Amaranthus ascendens* (redroot pigweed), *Dinebra retroflexa* (viper grass), *Portulaca oleracea* (duckweed), *Euphorbia geniculata*(painted spurge), *Xanthium strumarium* (cocklebur), *Brachiria reptans* (creeping panic grass), *Cyperus rotundus* (cocco-grass), *Cynodon dactylon* (Bermudagrass), *Setaria parviflora* (roundworm), *Cynanchum acutum*.

3.2. Biodervsity in soil seed bank in vertical and horizontal distribution

Table (2) and Fig. (1) show major variation in weed seed bank size in vertical soil profile or horizontal distribution in studied basins in both studied summer seasons. The number of germinated seeds/kg of soil through 15 cm soil profile sections varied greatly from one basin to another. These differences may be attributed to the differences in crop sequences and tillage systems followed in these basins. In all basins, most of weed seeds were concentrated in 0-5 cm soil layer followed by 5-10 cm soil layer and the lowest once were found in 10-15cm soil layer. These results were statistically true and in agreement with those obtained by Prabhu *et al*. (2015) who mentioned that smaller size of seed bank at 15-30 cm than 0-15 cm soil depth and Khan *et al*. (2012), who mentioned that the majority of the weed seed germinated from the soil samples collected from the above 5cm soil surface.

Table (2): Vertical and horizontal distributions of germinated weed seeds in soil profile in the studied basins in Giza research station during 2018 and 2019 summer seasons.

Basin number	Soil depths (cm)	2018 summer season		2019 summer season	
		No. of seedling kg^{-1}	Seedling %	No. of seedling kg^{-1}	Seedling %
5	0 - 5	148.8	51.5	175.1	56.2
	5 - 10	115.8	40.1	100.3	32.2
	10 - 15	24.3	8.4	36.4	11.7
	L.S.D. 0.05	0.93		1.56	
	Total	288.8	100.0	311.7	100.0
6	0 - 5	135.0	47.7	151.2	53.3
	5 - 10	93.1	32.9	85.2	30.0
	10 - 15	55.1	19.5	47.5	16.7
	L.S.D. 0.05	1.3		0.7	
	Total	283.2	100.0	283.9	100.0
12	0 - 5	209.2	41.94	187.7	46.0
	5 - 10	178.2	35.7	142.7	35.0
	10 - 15	111.4	22.3	77.7	19.1
	L.S.D. 0.05	1.5		1.1	
	Total	498.8	100.0	408.1	100.0
19	0 - 5	22.5	49.2	30.6	47.8
	5 - 10	13.4	29.2	23.6	36.8
	10 - 15	9.9	21.6	9.8	15.3
	L.S.D. 0.05	0.2		0.27	
	Total	45.7	100.0	64.0	100.0
20	0 - 5	57.5	46.0	135.4	35.9
	5 - 10	40.6	32.4	110.7	29.2
	10 - 15	27.0	21.6	132.0	34.9
	L.S.D. 0.05	0.54		0.62	
	Total	125.1	100.0	377.7	100.0

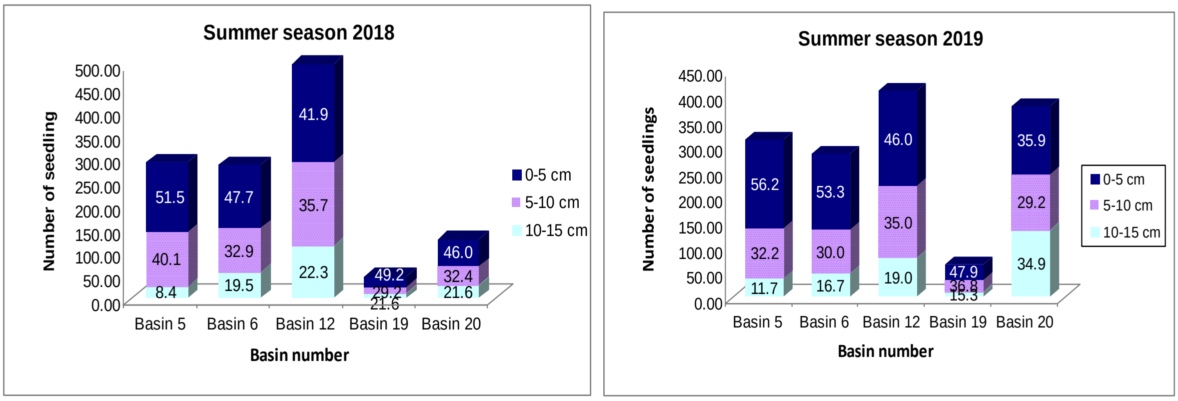

Fig. (1): Variation in weed seed bank size in vertical soil profile in one side and horizontal distribution in the studied basins in both summer seasons 2018 & 2019.

On the other hand, horizontal seed bank distribution between various studied basins showed that the total seed bank in 0-15 cm depth varied largely in the number of seeds/kg soil, which can be ranked from the highest seed bank to the lowest basin in the following order 489.83, 288.79, 283.16,125.08 and 45.75 seeds/kg soil with basins No. 12, 5, 6, 20 and 19, respectively, in the first season. In the second season the seedling seed bank arranged from highest seed bank to the lowest basin in the following order 408.05, 377.69, 311.74, 283.89 and 64.00 seeds/kg soil for basins No. 12, 20, 5, 6and 19 respectively. Douglas *et al*. (2001) also found concentrated weed seed in the upper 10 cm of the soil profile due to different cultural practices. Our findings are in conformity with those of Mirsky *et al*. (2010) and with those obtained by Khan *et al*. (2012) who also reported that when the soil disturbance was deep, the maximum seed go deep into the soil and increased the soil seed bank.

3.3. Determination of suitable number of germination cycles

The results in Table (3) and Fig. (2) show that 5-6 weekly cycles of weed germination are needed to determine germination of summer weed seeds kg^{-1} soil through summer season, where most of weed seeds germinated in the 1st & the 2nd weeks and decreased gradually in the 5th & the 6th weeks. The germinated weed seeds in the 6th week represent less than 5 percent from the total germinated weed seeds. These results were observed in both studied seasons and in harmony with those obtained by Khan *et al*. (2012).

3.4. Number of samples, experimental error and coefficient of variance (CV%) and their relations to seed bank

Table (4) and Fig. (3) show the number of germinated seeds per kilogram of soil from soil surface until 15 cm depth, and that CV% values generally tend to decrease with increasing weed seed bank density. And the experimental error decreased with increasing the number of soil samples from 2 to 4 samples, than one soil sample and in general four samples were more adequate than 2-3 samples, where one sample was not accurate in seed bank determination at all, which had high experimental error. Some researchers as Gholashan and Yasari (2012) found that five samples were almost the same as 30 samples and was very desirable to save time and money, which are of concern in estimating seed bank.

Conclusion

It is necessary for understanding soil seed bank to study its vertical and horizontal distributions to plan long-term and short term weed management, depending on understanding weed seedbank nature concerning weed seed densities and germination cycle of species in soil layers. This study shed lights on weed seed distribution in the soil. Also, provides mathematical models which govern weed seed distribution in the soil profile to sustain crop production in Egypt.

Table (3): Number of germinated weed seeds weekly during six weeks of irrigation in 2018 and 2019 summer seasons.

Basin number	Weeks after irrigation	Summer 2018		Summer 2019	
		No. of seedlings	Seedlings %	No. of seedlings	Seedlings %
5	First	77.8	26.9	80.81	25.9
	Second	94.9	32.9	101.1	32.4
	Third	42.1	14.6	50.0	16.0
	Fourth	31.6	10.9	40.1	12.9
	Fifth	24.4	8.4	23.31	7.5
	Sixth	17.9	6.2	16.4	5.2
	Total	288.8	100.0	311.7	100.0
	L.S.D. 0.05	1.3		2.2	
6	First	93.1	32.9	90.1	31.7
	Second	75.3	26.6	73.9	26.0
	Third	49.0	17.3	52.9	18.6
	Fourth	29.1	10.3	35.9	12.6
	Fifth	23.3	8.2	19.6	6.9
	Sixth	13.3	4.7	11.5	4.0
	Total	283.2	100.0	283.9	100.0
	L.S.D. 0.05	1.78		1.02	
12	First	148.6	29.8	148.7	36.4
	Second	125.1	25.1	117.7	28.9
	Third	86.9	17.4	72.7	17.8
	Fourth	67.5	13.53	37.7	9.2
	Fifth	46.5	9.32	20.3	5.0
	Sixth	24.2	4.8	10.9	2.7
	Total	498.8	100.0	408.0	100.0
	L.S.D. 0.05	2.071		1.599	
19	First	17.38	37.98	22.75	35.55
	Second	14.31	31.29	16.88	26.37
	Third	6.00	13.11	12.44	19.43
	Fourth	4.38	9.56	6.19	9.67
	Fifth	2.81	6.15	3.56	5.57
	Sixth	0.87	1.91	2.19	3.42
	Total	45.75	100.00	64.00	100.00
	L.S.D. 0.05	0.34		0.38	
20	First	42.7	34.1	108.5	28.7
	Second	37.1	29.7	109.1	28.9
	Third	23.6	18.8	65.7	17.4
	Fourth	14.4	11.5	43.1	11.4
	Fifth	4.7	3.7	29.8	7.9
	Sixth	2.6	2.0	21.5	5.7
	Total	125.0	100.00	377.7	100.0
	L.S.D. 0.05	0.8		0.9	

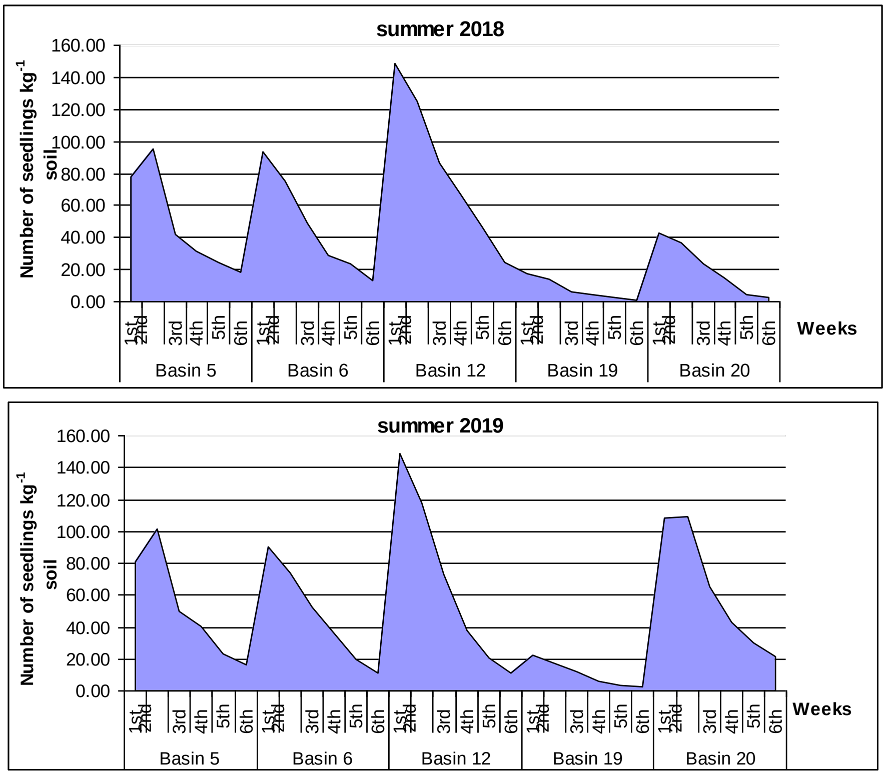

Fig. (2): Number of germinated seeds weekly in each soil / kg during 2018 and 2019 summer seasons.

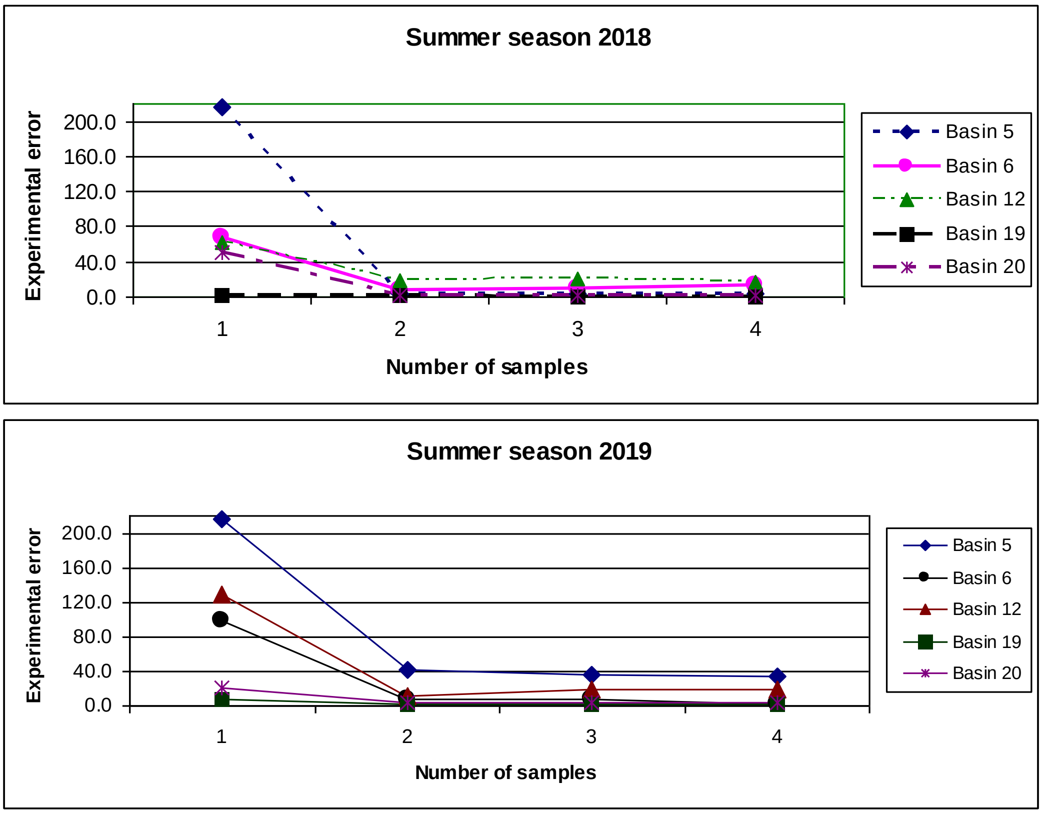

Fig. (3): The relationship between the number of studied soil samples and the experimental error during 2018 & 2019 seasons.

Table (4): Horizontal distribution and the number of soil samples of non dormant weed seed bank in the studied Giza station's basins during 2018 & 2019 summer seasons.

Basin number		Number of samples							
		2018				2019			
		One	Two	Three	Four	One	Two	Three	Four
5	Total number of seedlings kg^{-1}	311.7	300.5	292.4	288.79	311.3	312.0	315.9	311.7
	Experimental error	215.4	4.4	3.6	3.05	215.4	41.1	35.5	33.5
	Sampling error	4.1	7.9	8.7	10.57	30.7	25.4	24.5	30.1
	CV%	11.7	16.9	17.8	20.3	32.0	29.1	28.2	31.7
6	Total number of seedlings kg^{-1}	281.0	281.8	292.4	283.16	287.2	282.7	315.9	311.7
	Experimental error	68.5	7.8	9.1	12.79	99.3	6.81	7.5	7.0
	Sampling error	6.9	7.4	19.1	19.64	5.4	6.4	6.2	6.5
	CV%	16.8	17.3	26.9	28.2	14.5	16.1	15.8	16.1
12	Total number of seedlings kg^{-1}	517.5	514.9	507.6	498.83	406.5	402.8	404.2	408.0
	Experimental error	62.6	19.4	20.7	17.12	129.6	11.6	18.5	19.0
	Sampling error	25.6	26.6	25.9	26.50	5.8	12.9	18.5	15.8
	CV%	17.6	18.0	18.1	18.6	10.6	16.1	19.2	17.5
19	Total number of seedlings kg^{-1}	48.5	46.8	46.3	45.75	61.8	62.9	63.7	64.0
	Experimental error	2.7	1.1	0.8	0.87	8.2	1.0	1.5	1.6
	Sampling error	0.6	0.8	0.7	0.70	0.9	1.01	0.9	0.9
	CV%	29.6	33.7	33.2	32.8	28.1	28.7	27.4	26.3
20	Total number of seedlings kg^{-1}	131.7	127.5	126.2	125.08	373.3	376.3	377.3	377.7
	Experimental error	51.6	2.1	2.0	2.4	20.9	4.2	3.6	4.5
	Sampling error	1.3	5.9	3.83	3.6	3.2	5.3	4.8	4.7
	CV%	15.5	34.3	27.9	27.3	8.6	11.0	10.5	10.3

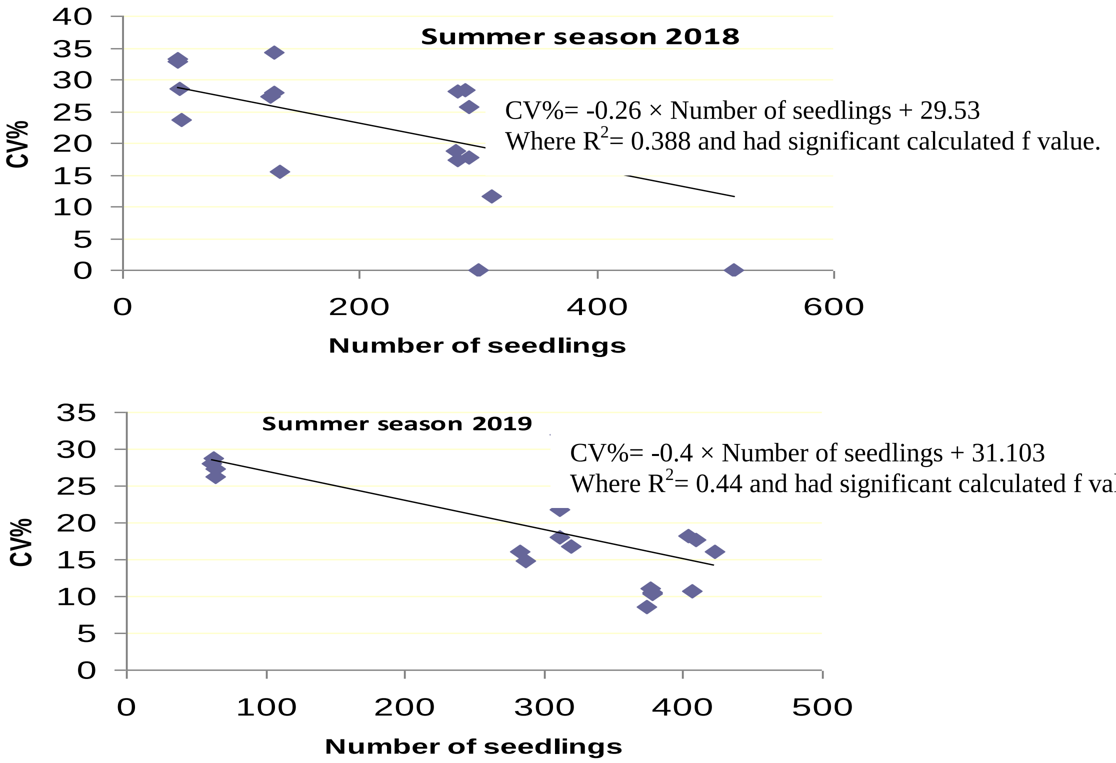

Fig. (4): The relationship between the number of studied soil samples and CV% during 2018 & 2019 seasons.

4. REFERENCES

Anderson R. L. (2004) Sequencing crops to minimize selection pressure for weeds in the Central Great Plains. Weed Tech., 18 (1): 157-164.

Ball D. A. (1992). Weed seedbank response to tillage, herbicides, and crop rotation sequence. Weed Sci., 40 (4): 654-659.

Buhler D. D., Hartzler R.G. and Forcella F. (1997). Implications of weed seedbank dynamics to weed management. Weed Sci., 45 (3): 329–336.

Chauvel B., Gasquez J. and Darmency H. (1989). Changes of weed seed bank parameters according to species, time and environment. Weed Res., 29: 213-219.

Douglas D.B., Kohler K. A. and Thompson R.I. (2001). Weed seed bank dynamics during a five-year crop rotation. Weed Techn. 15 (1): 170-176.

Forcella F, Eradat-Oskoui K and Wagner S.W. (1993). Application of weed seed bank ecology to low-input crop management. Ecol. Appl. ; 3 (1): 74-83.

Forcella F., Durgan B. and Buhler D. D. (1996). Management of weed seeedbank. International Weed Control Congress Proceedings.

Forcella F., Webster T. and Cardina J. (2003). Protocols for weed seed bank determination in agro-ecosystems. Weed management for developing countries 120 Addendum FAO edition, Labrada, 1-18.

Garrison A. J., Miller A. D., Ryan M. R., Roxburgh S. H. and Shea K. (2014). Stacked crop rotations exploit weed-weed competition for sustainable weed management. Weed Sci., 62: 166–176.

Golafshan M. G. and Yasari E. (2012). Comparison of sampling methods for estimating seed bank and weed population densities during the growing season. J. Agric. Sci.; 4 (9): 39-47.

Hossain M. M. and Begum M. (2015). Soil weed seed bank: Importance and management for sustainable crop production- A Review. J. Bangladesh Agril. Univ., 13 (2): 221–228.

Jones N. (1998). Number of soil cores required to accurately estimate the seed bank on arable land. Aspect. Appl. Biol. 51: 1-8.

Kellman M. (1978). Microdistribution of viable weed seed in two tropical soils. J. Biogeography., 5 (3): 291–300.

Khan A. M., Hussain Z., Khan I., Khan R., Waqas M., Haroon M., Ali Z. and Khan

I.A.(2012). Studies on weed seed bank of new developmental farm. KPK Agricultural University Peshawar, Pakistan., Pak. J. Weed Sci. Res. 18(2): 183-189.

Leibman M. and Davis A.S. (2009). Managing weed in organic farming systems: An ecological approach. In Organic Farming: The Ecological System; Francis, C., (Ed.), American Society of Agronomy: Madison, WI, USA, 173–196.

Leighty C.E. (1938). Crop rotation. In Year-book of Agriculture: Soils and Men; U.S. Government Printing Office: Washington, DC, USA, 406–430.

Mirsky S. B., Gallandt E. R., Curran W.S. and Shumway D. L.. (2010). Reducing the germinable weed seedbank with soil disturbance and cover crops. Weed Res., 50: 341–352.

Prabhu G., Srinivasan R., Kantwa S. R., Palsaniya D. R. and Chaudhary M. (2015). Weed seed bank studies in the field of Fodder Cowpea [*Vigna unguiculata* (L.)]. Int. J. Appl. Pure Sci. and Agric., 1 (5): 83-87.

Steel R.G. D. and Torrie J. H. (1980). Principles and Procedures of Statistics. McGraw Hill Book Co., Inc. New York, 481.

Teo-Sherrell C.P. A., Mortensen D.A. and Keaton M. E. (1996). Fates of weed seeds in soil: A seeded core method of study. J. Appl. Ecol. 33 (5): 1107–1113.

Wiles L. J. and Schweizer E. G. (1999). The cost of counting and identifying weed seeds and seedlings. Weed Sci., 47: 66-73.

دراسة أولية على مخزون بذور الحشائش الصيفية القابل للإنبات في مزرعة بحوث الجيزة مركز البحوث الزراعية، الجيزة، مصر

مها فهيم العناني - إيناس محمد كامل - عزة السيد خفاجى

المعمل المركزي لبحوث الحشائش – مركز البحوث الزراعية – الجيزة - مصر

ملخص

أصبحت دراسات مخزون البذور في التربة هي حجر الزاوية وأحد مكونات الإدارة المتكاملة للحشائش في النظم الزراعية على مستوى العالم. وحتى الآن لا توجد دراسات كافية عن مخزون بذور الحشائش في مصر. لهذا السبب تم البدء في دراسة رائدة بمصر عن مخزون بذور الحشائش بهدف استخدامها في رسم استراتيجيات مكافحة الحشائش في النظم الزراعية بمصر. أجريت هذه الدراسة في الموسم الصيفى لعامي 2018، 2019 في عدد خمس أحواض زراعية بمحطة البحوث الزراعية بمركز البحوث الزراعية بالجيزة هي أحواض أرقام 5، 6، 12، 19، 20 والتي تمثل الجهات شرق، غرب، شمال، جنوب، ووسط المزرعة. تم أخذ عدد أربع عينات من التربة من كل حوض من ثلاث أعماق هي 5، 10، 15 سم ووضعت هذه العينات في أصص قطرها 25 سم في الصوبة السلكية بالمعمل المركزي لبحوث الحشائش وتم ريها حسب الحاجة. تم متابعة إنبات بذور الحشائش دوريا لمدة 6 أسابيع حيث يتم عد بادرات الحشائش أسبوعيا. أشارت النتائج إلى أن معظم بذور الحشائش التي تم انباتها وجدت في طبقة التربة السطحية بعمق 5سم من سطح التربة يليها في العدد عند عمق 10سم وكان عمق 15سم أقلهما عددا. كما أوضحت النتائج أن معظم بذور الحشائش يتم إنباتها في الأسبوعين الأول والثاني ، وأن أكثر من 95% تنبت في فترة الخمس أسابيع الأولى من بدء الري. كما أختلفت الحشائش في كثافتها وعدد أنواعها من حوض لآخر حيث بلغ عدد الأنواع الموجودة في الأحواض المختلفة ثمانية عشر نوعا. كان أعلى عدد من بذور الحشائش النامية في حوض 12 (498.83 و 408.05 بادرة/كجم) في الموسمين الأول والثاني بينما أقل عدد من البذور النامية في حوضي 19 (45.75 و64.00 بادرة/كجم) في الموسمين الأول والثاني على الترتيب. وأشارت النتائج أنه باستخدام التحليل الإحصائي اتضح انخفاض الخطأ التجريبي باستخدام 3-4 عينات تربة من كل حوض عنه عند أخذ عينة واحدة لتقدير مخزون الحشائش الصيفية القابلة للانبات بدقة. كما اتجه معامل الإختلاف (CV%) إلى النقص مع زيادة عدد بادرات البذور النامية لكل كيلو جرام من التربة. وكانت العلاقة بين كثافة البادرات ومعامل الاختلاف علاقة خطية من الدرجة الأولى "معامل الاختلاف%=-0.26×عدد بادرات الحشائش+29.53" في الموسم الصيفي الأول وأيضا في الموسم الصيفي الثاني تمثلها معادلة من الدرجة الأولى وهي "معامل الاختلاف%=-0.4×عدد بادرات الحشائش+31.103". يستخلص من هذه الدراسة أن تقدير مخزون بذور الحشائش في التربة من حيث توزيعها رأسيا وأفقيا ومن حيث توزيعها في الموسم الصيفي يعتبر مفتاحا أساسيا للإدارة المحسنة للحشائش في المحاصيل الصيفية في مصر.

المجلة العلمية لكلية الزراعة - جامعة القاهرة- المجلد (71) العدد الرابع اكتوبر (2020): 279-288.