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Improving integrated management of weed control by determination of weed seed bank in sandy and clay soil

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A B S T R A C T

Knowledge of soil weed seed bank is important for population dynamics studied, establishment of appropriate weed management programs, a little effort in understanding weed seed bank can give valuable information about what weeds to expect in growing season, weed density, and when most weed germination will take place. In this study, a two-year's, two sites were carried out with the aim of assessing weed seed bank status of the soil throughout 2018 and 2019. A site was worked out in Sakha Agriculture Research farm act as a clay soil, Kafr El-Sheikh Governorate, Agriculture Research Center (ARC). Another site was worked out in El-Ismailia Agr; Res; farm act as sandy soil, El-Ismailia Governorate, ARC. At each site, soil samples were selected from nine different places as like three Zigzag shapes divided into three, six and nine sites, “W” to act the whole soil area (30 faddan in Sakha farm, and 15 faddan in El-Ismailia farm). The soil samples were taken from topsoil 0–10 cm depth with an auger (core) 10 cm diameter the soils without tillage and before sowing the summer crop. The result of present the study in two different stations and soils, revealed that the number of soil samples to estimate weed seed banks should be either six or nine sites; each sample weighted 0.50 Kg soil with zigzag shape act a direct seed extraction technique to able recognize the abundance of weed species into the soil and their seed density. The aim is to improve integrated weed control.

1. Introduction

Weeds are a major biological constraint, because adverse impacts on crop yields by interfering with crop growth and development through allelopathy and competition for water, nutrients, light and space. Weed seeds are an important component of the weed life cycle as they are the origin of future populations (Hossain and Begum, 2015). This review focuses on soil seed banks which are the most common and important in agricultural systems. The weed seed bank is the reserve of viable weed seeds present on the soil sur-

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seed extraction method, weed seeds are extracted by washing and floatation methods while in the second technique, weed seedling emergence, the soil sample is placed in the green house on controlled environment, watered on regular basis in order to emerge the weed seedling and these emerged seedlings are then identified and counted (Mahé et al., 2021; Shar et al., 2016). The difficulty of monitoring a process that accrued mostly underground has deter-
rent weed scientists from gaining a full understanding of the weed seed bank. Nevertheless, current knowledge about weed seed banks has shown some potential management options. Reducing inputs to that seed bank is an important component of seed bank management, while other strategies like using a no – till cropping system can be used to directly affect germination, persistence and mortality of weed seeds. Managing weed seed banks would be an important component of integrated weed management (Hossain and Begum, 2015; Shar et al., 2016). Weed seed banks are an ever-present component of agriculture land, and resource directed to understanding interpreting and predicting seed germination potential can improve agricultural production (LeBaron and Müller, 2008). Soil acts as storage house for different macro and microorganisms including insects, microorganisms, fungi, algae, spores, nematodes and seeds of different weeds. Plants after maturation shed thin seeds and these weed seeds ultimately accumulated in the soil profile which form weed seed bank in the soil profile (Forcella et al., 2003). The soil seed bank is the natural storage of seeds, after dormant within the soil of most ecosystems (Dekker, 1999). Soil seed weed bank is natural source for weed infestation. Determination of soil weed seed bank has primary importance to get complete picture of weed seed reservoir in the soil profile (Hussain et al., 2017). The production of a large number of small seeds is an important survival strategy developed by weeds to survive control methods. After their dispersal, the seeds might remain on the soil surface or burial depth by various biotic and a biotic agent, thus farming a soil seed bank that becomes the primary source of weeds in agro ecosystems (Shiferaw et al., 2018; Zhang et al., 2019). Weed seeds disperse both horizontally and vertically in the soil profile. While the horizontal distribution of weed seeds in the seed bank generally follows the direction of crop rows; type of tillage is the main factor determining the vertical distribution of weed seeds within the soil profile, knowing something about seed bank content before the season start can help the farmer prevent severe weed problems before they develop. Seed banks typically are confined to the surface and upper 30 cm of soil. Sampling soil usually is a necessary component of seed bank studies. The most obvious questions that arise are: How many and what size soil samples should be taken? The amount of soil sampled is a product of the number of cores and the size of the cores. Core size involves core area or diameter (most soil sampling tools are tubes with circular orifices) and also core depth (Forcella et al., 2003). Soil seed banks are comprised of both dormant and no dormant seeds persisting at varying depth within the surface soil profile (Davis et al., 2008). The reason the weed seed bank is so difficult to manage is because it contains not only many seeds, but many different kinds of seeds, with typically 20–50 different weed species in a single field (Hossain and Begum, 2015; Rind et al., 2021). Studying weed seed bank possible to assess the potential size of the weed seed bank because many species are capable of extended fluxes of emergence over several weeks under favorable environmental conditions (Mayor and Dessaint, 1998; Shar et al., 2019). There is a need to understand soil weed seed bank dynamics, this might contribute to the prediction of infestations and could lead to improved management strategies for minimizing the effects of the interference of invasive plants with crop growth and yields. Weed seeds can have numerous fates after they are dispersed into a field resulted of the many seeds in the bank, very few will actually emerge and reduce a plant with most seeds will die, decompose or be eaten before ever germinating. Seeds from many species can remain viable for long periods but do not germinate because they possess some degree of physical or physiological dormancy, while others can germinate but do not emerge due to unfavorable environmental conditions. Phytosociological structure was assessed using parameters such as the absolute and relation value of frequency, density, abundance and the importance and value index for each species (Hossain and Begum, 2015). The aim is to improve integrated weed control.

2. Materials and methods

In this study, a two - year’s, two sites were carried out with the aim of assessing weed seed bank status of the soil throughout 2018 and 2019. A site was worked out in Sakha Agriculture Research farm act as a clay soil, Kafr El-Sheikh Governorate, Agriculture Research Center (ARC). Another site was worked out in El-
Ismailia Agr; Res; farm act as sandy soil; El-Ismailia Governorate; ARC. At each site, soil samples were selected from nine different places as like three Zigzag shapes divided into three, six and nine sites, “W” to act the whole soil area (30faddan in Sakha farm, and 15 faddan in El-Ismailia farm). The soil samples were taken from top soil 0–10 cm depth with an auger (core) 10 cm diameter the soils without tillage and before sowing the summer crop.

These soil samples are consisted of both new weed seeds recently shed and older seeds that have persisted in the soil for several years. In each place, seeds removal from the soil samples by washed in tap water to remove soil particles, dried, then screened to separate by different sizes and identify the weed species under a binocular microscope.

Each side was included nine soil samples. Each sample was consisted of 0.5 kg soil. The zigzag shape of the nine soil samples was divided into three size categories; to recognize the differences of the weed’s density and species between them as follows:

Number of soil samples treatments:

1. 3, 7 and 9 soil samples
2. 2, 3, 4, 5, 6 and 9 soil samples
3. 1, 2, 3, 4, 5, 6, 7, 8 and 9 soil samples

At each site, soil samples were selected from nine different places as like three Zigzag shapes divided into three, six and nine sites, “W” to act the whole soil area (30faddan in Sakha farm, and 15 faddan in El-Ismailia farm), as shown in the following figure:

![Diagram](image-url)

The optioned data as Follows:

1. Recorded the major weeds species in Sakha and Ismailia stations
2. Estimated the weeds density with determined the dominant weed species by calculate the seed index % of each weed species by equation of:

   \[
   \text{Seed index} = \frac{\text{No. of individual seeds species}}{\text{Total No. of all weed seed species}}
   \]

3. Showed the ideal shape and size for weed seed bank studies
3. Results

Weed species of the soil samples in Sakha Research Station are classified in Table 1, twenty annual species belong to ten family's and fifteen genera are recorded. They classified into two categories fifteen broadleaf weeds: Amaranthus ascendens (Amaranthaceae), Anagallis arvensis (Purshiaeae), Beta vulgaris (Chenopodiaceae), Brassica kaber (Brassicaceae), Capsella bursa-pastoris (Brassicaceae), Chenopodium album (Chenopodiaceae), Cichorium endivia (Asteraceae), Corchorus olitorius (Tiliaceae), Ipomea cairica (Morningglory), Lathyrus hirisutus (Fabaceae), Melilotus indica (Famcaceae), Silybum marinum (Brassicaceae), Sonchus oleraceus (Asteraceae) and five narrowleaf weeds: Echinochloa colonum, Phalaris minor, Phalaris paradoxa, Polygonon monspeliensis, Setaria viridis were belonged to Poaceae family (Soumia, 2021); explained that the dynamics Weed Seed Bank; Seed banks are generally composed of numerous species belonging to three groups. The first group includes dominant species accounting for 70–90% of the total seed bank. These species represent most of the weed problems in a cropping system. Second group of species comprise of 10–20% of the seed bank, including those adapted to the geographic area but not to current production practices. The final group accounts for a small percentage of the total seed and includes recalcitrant seeds from previous seed banks of the previous crop (Rao, 2000); explained that the soil weed seed bank is natural source for weed infestation.

1. Sakha Res. Station farm

1.1. In first season, as shown from Table 2, the dominant annual broadleaf weeds were i.e. Portulaca oleraceae was presented in nine soil samples with sum 154.8, and seed index 35.43%; Anagallis arvensis was presented in six soil samples with sum 50.5, and seed index 11.56%; meanwhile the dominant grassy weeds were i.e. Phalaris minor was presented in seven soil samples with sum 41.2, and seed index 9.43%. Echinochloa colonum was presented in five soil samples with sum 26.8, and seed index 6.13%. Whist

| Serial | Location | Sakha season 2017 | Number of soil Sample | Scientific name | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Sum. | Av. | seed index% | LSD at 5% |
|--------|----------|-------------------|-----------------------|-----------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-------------------|
| 1      | Sillybum marium | 2.27 | 3a | 3.6 | 0.83 | 1.23 |
| 2      | Cichorium endivia | 6.6a | 6a | 5.3b | 1c | 5.3b | 29.2 | 6.74 | 1.16 |
| 3      | Phalaris paradoxa | 10a | 10 | 1.1 | 2.31 | 0.57 |
| 4      | Melilotus indica | 3a | 3 | 0.33 | 0.69 | 1.14 |
| 5      | Polygonon monspeliensis | 3a | 3 | 0.33 | 0.69 | 1.14 |
| 6      | Setaria viridis | 7a | 7 | 0.77 | 1.62 | 1.14 |
| 7      | Brassica kaber | 4a | 4 | 0.44 | 0.93 | 0.57 |
| 8      | Chenopodium album | 4a | 4a | 1.3b | 1.3b | 6.6 | 0.73 | 1.53 | 0.73 |
| 9      | Portulaca oleraceae | 23.6c | 23.6c | 3.6g | 23.3c | 11.3f | 13.6e | 16d | 183.7 | 20.4 | 42.52 | 2.16 |
| 10     | Anagallis arvensis | 10.3b | 5c | 23.3a | 2.3d | 5.3c | 45.2 | 5.02 | 10.46 | 0.66 |
| 11     | Phalaris minor | 7.3b | 7.3b | 11.6a | 6b | 2.6d | 1e | 26.6 | 2.95 | 6.16 | 0.66 |
| 12     | Anamarturus ascendenes | 5.3a | 5a | 4.3a | 14.6 | 16.2 | 1.14 |
| 13     | Lathyrus hirsutus | 6a | 6a | 12 | 1.3 | 2.78 | 0.57 |
| 14     | Capsella bursa-pastoris | 1.6a | 1.6a | 6.2 | 0.68 | 1.44 | 0.93 |
| 15     | Sonchus oleraceae | 7.3a | 3.5a | 5.3 | 0.58 | 1.23 | 0.33 |
| 16     | Rumex dentatus | 7.3a | 5.3b | 12.6 | 14 | 2.92 | 0.46 |
| 17     | Beta vulgaris | 2.3a | 2.3 | 0.255 | 0.53 | 0.33 |
| 18     | Ipomea cairica | 37.3a | 11.3c | 15.3b | 6g | 6d | 2.6f | 7.6d | 4e | 8c | 92.1 | 10.23 | 2.11 |
| 19     | Total grassy weeds | 54b | 26.6f | 60a | 35e | 39cd | 41.6c | 27f | 20.3g | 36.6de | 340.1 | 37.78 | 2.87 |
| 20     | Total broad-leaves weeds | 91.3a | 38d | 75.3b | 34.6e | 45c | 44.3c | 34.6f | 24.3g | 44.6c | 432 | 48 | 10 | 2.74 |
The presented weed species were presented in low density and located between 1, 2, 3 soil samples.

Table 2, in 3, 7 and 9 zigzag shape, there were the presented nine weed species i.e. *Silybum marium*, *Chenopodium endivia*, *Brassica kaber*, *Cichorium endivia*, *Anagallis arvensis*, *Lathyrus hirsutus*, *Ipomea cairica* as broad-leave weeds and *Phalris minor* as grassy weeds. The preeminent weed species were *Portulaca oleracea* (65 seeds), *Phalris minor* (20 seeds), *Cichorium endivia* (14 seeds), *Silybum marium* (7 seeds).

Table 3, in 2, 3, 4, 5, 6 and 9 zigzag shape, there were the presented sixteen weed species i.e. *Silybum marium*, *Chenopodium endivia*, *Brassica kaber*, *Chenopodium album*, *Portulaca oleracea*, *Anagallis arvensis*, *Lathyrus hirsutus*, *Ipomea cairica*, *Melilotus indica*, *Amaranthus ascenden*, *Capsella bursa-pastoris*, *Corchorus olitorius*, *Sonchus oleraceus*, *Rumex dentatus* as broad-leave weeds and *Phalris minor* and *Echinocloa colonum* as grassy weeds. The preeminent weed species were *Portulaca oleracea* (122 seeds), *Anagallis arvensis* (32 seeds), *Phalris minor* (23 seeds), *Cichorium endivia* (21 seeds), *Lathyrus hirsutus* (16 seeds) and *Silybum marium* (10 seeds).

Table 4, in 1, 2, 3, 4, 5, 6, 7, 8 and 9 zigzag shape, there were the presented twenty weed species i.e. *Silybum marium*, *Chenopodium endivia*, *Brassica kaber*, *Chenopodium album*, *Portulaca oleracea*, *Anagallis arvensis*, *Lathyrus hirsutus*, *Ipomea cairica*, *Melilotus indica*, *Amaranthus ascenden*, *Capsella bursa-pastoris*, *Corchorus olitorius*, *Sonchus oleraceus*, *Rumex dentatus* and *Beta vulgaris* as broad-leave weeds and *Phalris minor*. *Echinocloa colonum*, *Phalaris paradoxa*, *Polypogon monspeliensis* and *Setaria viridis* as grassy weeds. The preeminent weed species were *Portulaca oleracea* (155 seeds), *Anagallis arvensis* (51 seeds), *Phalris minor* (41 seeds), *Chenopodium endivia* (29 seeds), *Echinocloa colonum* (27 seeds), *Rumex dentatus* (16 seeds), *Lathyrus hirsutus* (16 seeds), *Amaranthus ascenden* (15 seeds), *Chenopodium album* (12 seeds) and *Silybum marium* (10 seeds).

1.2. In second season, as shown from Table 2 the dominant annual broadleaf weeds were i.e *Portulaca oleracea* was presented in nine soil samples with sum 183.7, and seed index 42.52%; *Anagallis arvensis* was presented in five soil samples with sum 45.2, and seed index 10.46%; meanwhile the dominant grassy weeds were i.e *Phalaris minor* was presented in six soil samples with sum 44.8, and seed index 10.37%. Whist the remainder weed species were presented in low density and located between 1, 2, 3 soil samples.

Table 2, in 3, 7 and 9 zigzag shape, there were the presented ten weed species i.e. *Silybum marium*, *Chenopodium endivia*, *Brassica kaber*, *Chenopodium album*, *Portulaca oleracea*, *Anagallis arvensis* and *Ipomea cairica* as broad-leave weeds and *Polypogon monspeliensis*, *Phalris minor* and *Echinocloa colonum* as grassy weeds. The preeminent weed species were *Portulaca oleracea* (70 seeds), *Phalris minor* (26 seeds), *Chenopodium endivia* (17 seeds).

Table 3, in 2, 3, 4, 5, 6 and 9 zigzag shape, there were the presented fifteen weed species i.e. *Silybum marium*, *Chenopodium endivia*, *Brassica kaber*, *Chenopodium album*, *Portulaca oleracea*, *Anagallis arvensis*, *Ipomea cairica*, *Melilotus indica*, *Amaranthus ascenden*, *Capsella bursa-pastoris*, *Corchorus olitorius*, *Sonchus oleraceus*, as broad-leave weeds and *Polypogon monspeliensis*, *Phalris minor* and *Echinocloa colonum* as grassy weeds. The preeminent weed species were *Portulaca oleracea* (123 seeds), *Anagallis arvensis* (30 seeds), *Phalris minor* (27 seeds), *Cichorium endivia* (23 seeds), *Echinocloa colonum* (13 seeds) and *Silybum marium* (7 seeds).

Table 4, in 1, 2, 3, 4, 5, 6, 7, 8 and 9 zigzag shape, there were the presented nineteen weed species i.e. *Silybum marium*, *Chenopodium endivia*, *Brassica kaber*, *Chenopodium album*, *Portulaca oleracea*, *Anagallis arvensis*, *Lathyrus hirsutus*, *Ipomea cairica*, *Melilotus indica*, *Amaranthus ascenden*, *Capsella bursa-pastoris*, *Corchorus olitorius*, *Sonchus oleraceus*, *Rumex dentatus*, *Beta vulgaris*, *Amaranthus ascendens*, *Capsella bursa-pastoris*, *Corchorus olitorius*, *Sonchus oleraceus*, *Rumex dentatus* as broad-leave weeds and *Phalris minor* as grassy weeds. The preeminent weed species were *Portulaca oleracea* (122 seeds), *Anagallis arvensis* (32 seeds), *Phalris minor* (23 seeds), *Cichorium endivia* (21 seeds), *Lathyrus hirsutus* (16 seeds) and *Silybum marium* (10 seeds).
Table 3
The presented weed species and number of seeds into 0.5 kg soil of six zigzag shapes at Sakha station, 2017 and 2018 seasons.

| Sakha station, 2017 | N. of samples | Silybum maratum | Cichorium endivia | Brassica kaber | Chenopodium album | Portulaca oleraceae | Anagallis arvensis | Phalaris minor | Lathyrus hirsutus | Ipomea carica | Melilotus indica | Echinocloa colonum | Amazonanthus ascendens | Capsella bursa-pastoris | Corchorus ollitorius | Sonchus oleraceus | Rumex dentatus |
|---------------------|----------------|-----------------|------------------|---------------|-------------------|---------------------|-------------------|----------------|-----------------|----------------|----------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| 1                   | 2.00           | 23.00           | 11.00            | 9.00          | 14.60             | 9.00                | 1.00              | 3.00           | 7.30            | 1.00           | 7.30           | 1.00              | 1.00              | 1.00              | 1.00              | 1.00              |
| 2                   | 1.60           | 6.00            | 5.00             | 3.00          | 4.00              | 6.00                | 12.30             | 3.30           | 3.00           | 3.00           | 3.30           | 3.30              | 3.30              | 3.00              | 3.00              | 3.00              |
| 3                   | 1.60           | 3.00            | 3.00             | 4.00          | 14.60             | 9.00                | 12.30             | 3.30           | 3.30           | 3.30           | 3.30           | 3.30              | 3.30              | 3.30              | 3.30              | 3.30              |
| 4                   | 1.60           | 5.00            | 5.00             | 3.00          | 4.00              | 6.00                | 12.30             | 3.30           | 3.30           | 3.30           | 3.30           | 3.30              | 3.30              | 3.30              | 3.30              | 3.30              |
| 5                   | 1.60           | 5.00            | 5.00             | 3.00          | 4.00              | 6.00                | 12.30             | 3.30           | 3.30           | 3.30           | 3.30           | 3.30              | 3.30              | 3.30              | 3.30              | 3.30              |
| 6                   | 1.60           | 5.00            | 5.00             | 3.00          | 4.00              | 6.00                | 12.30             | 3.30           | 3.30           | 3.30           | 3.30           | 3.30              | 3.30              | 3.30              | 3.30              | 3.30              |
| 7                   | 1.60           | 5.00            | 5.00             | 3.00          | 4.00              | 6.00                | 12.30             | 3.30           | 3.30           | 3.30           | 3.30           | 3.30              | 3.30              | 3.30              | 3.30              | 3.30              |
| 8                   | 1.60           | 5.00            | 5.00             | 3.00          | 4.00              | 6.00                | 12.30             | 3.30           | 3.30           | 3.30           | 3.30           | 3.30              | 3.30              | 3.30              | 3.30              | 3.30              |
| 9                   | 1.60           | 5.00            | 5.00             | 3.00          | 4.00              | 6.00                | 12.30             | 3.30           | 3.30           | 3.30           | 3.30           | 3.30              | 3.30              | 3.30              | 3.30              | 3.30              |
| Total               | 1.60           | 5.00            | 5.00             | 3.00          | 4.00              | 6.00                | 12.30             | 3.30           | 3.30           | 3.30           | 3.30           | 3.30              | 3.30              | 3.30              | 3.30              | 3.30              |

Table 4
The presented weed species and number of seeds into 0.5 kg soil of nine zigzag shapes at Sakha station, 2017 and 2018 seasons.

| Sakha station, 2017 | N. of samples | Silybum maratum | Cichorium endivia | Brassica kaber | Chenopodium album | Portulaca oleraceae | Anagallis arvensis | Phalaris minor | Lathyrus hirsutus | Ipomea carica | Melilotus indica | Echinocloa colonum | Amazonanthus ascendens | Capsella bursa-pastoris | Corchorus ollitorius | Sonchus oleraceus | Rumex dentatus |
|---------------------|----------------|-----------------|------------------|---------------|-------------------|---------------------|-------------------|----------------|-----------------|----------------|----------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| 1                   | 1.60           | 3.00            | 13.60            | 5.00          | 7.30              | 1.00                | 1.00              | 1.00           | 1.00            | 1.00           | 1.00           | 1.00              | 1.00              | 1.00              | 1.00              | 1.00              |
| 2                   | 1.60           | 3.00            | 13.60            | 5.00          | 7.30              | 1.00                | 1.00              | 1.00           | 1.00            | 1.00           | 1.00           | 1.00              | 1.00              | 1.00              | 1.00              | 1.00              |
| 3                   | 1.60           | 3.00            | 13.60            | 5.00          | 7.30              | 1.00                | 1.00              | 1.00           | 1.00            | 1.00           | 1.00           | 1.00              | 1.00              | 1.00              | 1.00              | 1.00              |
| 4                   | 1.60           | 3.00            | 13.60            | 5.00          | 7.30              | 1.00                | 1.00              | 1.00           | 1.00            | 1.00           | 1.00           | 1.00              | 1.00              | 1.00              | 1.00              | 1.00              |
| 5                   | 1.60           | 3.00            | 13.60            | 5.00          | 7.30              | 1.00                | 1.00              | 1.00           | 1.00            | 1.00           | 1.00           | 1.00              | 1.00              | 1.00              | 1.00              | 1.00              |
| 6                   | 1.60           | 3.00            | 13.60            | 5.00          | 7.30              | 1.00                | 1.00              | 1.00           | 1.00            | 1.00           | 1.00           | 1.00              | 1.00              | 1.00              | 1.00              | 1.00              |
| 7                   | 1.60           | 3.00            | 13.60            | 5.00          | 7.30              | 1.00                | 1.00              | 1.00           | 1.00            | 1.00           | 1.00           | 1.00              | 1.00              | 1.00              | 1.00              | 1.00              |
| 8                   | 1.60           | 3.00            | 13.60            | 5.00          | 7.30              | 1.00                | 1.00              | 1.00           | 1.00            | 1.00           | 1.00           | 1.00              | 1.00              | 1.00              | 1.00              | 1.00              |
| 9                   | 1.60           | 3.00            | 13.60            | 5.00          | 7.30              | 1.00                | 1.00              | 1.00           | 1.00            | 1.00           | 1.00           | 1.00              | 1.00              | 1.00              | 1.00              | 1.00              |
| Total               | 1.60           | 3.00            | 13.60            | 5.00          | 7.30              | 1.00                | 1.00              | 1.00           | 1.00            | 1.00           | 1.00           | 1.00              | 1.00              | 1.00              | 1.00              | 1.00              | 1.00              |
Sonchus oleraceus, Rumex dentatus and Beta vulgaris as broad-leave weeds and Polygonum monspeliensis, Phalaris minor, Echinocloa colo- num, and Setaria viridis as grassy weeds. The preeminent weed species were Portulaca oleracea (184 seeds), Anagallis arvensis (45 seeds), Phalaris minor (45 seeds), Cichorium endivia (29 seeds), Echinochloa colonum (27 seeds), Amaranthus ascendens (15 seeds), Rumex dentatus (13 seeds).

Given the figure opposite number of total seed weeds species 0.5 kg soil in the Sakha research farm station first year, find that the total number of weeds output of three samples (3, 7 and 9) by 138.5 resulted from 9 species of weeds; The six samples (2, 3, 4, 5, 6 and 9) by 347.1 from 16 species and nine samples (1, 2, 3, 4, 5, 6, 7, 8, 9) by 502.3 from 20 species; while number of total seed weeds species 0.5 kg soil in the Ismailia research farm station first year, three samples (3, 7 and 9) by 185.5 resulted from 18 species; The six samples (2, 3, 4, 5, 6 and 9) by 310.4 from 16 species and nine samples (1, 2, 3, 4, 5, 6, 7, 8, 9) by 442.2 from 20 species. Weed species of the soil sample in Ismailia Research Station as sandy soil are summarized in Table 4, twenty-four annual species belong to eleven family's and thirteen genera are recorded. They classified into two categories thirteen broadleaf weeds Amaranthus ascen- dens (Amaranthaceae), Anagalis arvensis (Purilaceae), Brassica kaber (Brassicaceae), Capsella bursa-pastoris (Brassicaceae), Cichorium endivia (Asteraceae), Convolvulus arvensis (Convolvulaceae), Cor- chorus olitorius (Tiliaceae), Emex spinosus (Polygonaceae), Ipomea cairica (Convolvulaceae), Lathyrus hirsutus (Fabaceae), Melilotus indica (Fabaceae), Portulaca oleracea (Portulaca), Rumex den- tatus (Polygonaceae) and eleven narrow leave weeds Avena fatua, Brachiaria repans, Chenopodium bifo- roxb, Dactylotenium egyptiut, Digitaria songanulis, Echinochloa colonum, Lolium temulentum, Pha- laris minor, Poa annua Polygopp monspelie.nes, Setaria viridis belonged to Poaceae family.

2. Ismailia Res. Station farm
2.1. In first season, as shown from Table 5 the dominant annual broadleaf weeds were i.e. Emex spinosus was presented in nine soil samples with sum 78.5, and seed index 17.6%; Portulaca oleracea was presented in seven soil samples with sum 49.3, and seed index 11.1%; whilst the dominant grassy weeds were i.e. Phalaris minor was presented in seven soil samples with sum 50.8, and seed index 11.4%; whilst the remainder weed species were presented in low density and located between 1, 2, 3 soil samples.

Table 6, in 3, 7 and 9 zigzag shape, there were the presented eighteen weed species i.e. Brassica kaber, Portulaca oleracea, Anagallis arvensis, Amaranthus ascendens, Lathyrus hirsutus, Capsella bursa- pastoris, Corchorus olitorius, Emex spinosus and Ipomea cairica, Chenopodium bifo- roxb and Convolvulus arvensis as broad-leave weeds and Polygonum monspeliensis, Setaria viridis, Echinochloa colonum, Brachiaria repans, Poa annua, Avena fatua and Lolium temulen- tum as grassy weeds. The preeminent weed species were Emex spinosus (33 seeds), Phalaris minor (24 seeds), Chenopodium bifo- roxb (21 seeds), Lolium temulentum (20 seeds) and Portulaca oleracea (18 seeds).

Table 7, in 2, 3, 4, 5, 6 and 9 zigzag shape, there were the presented twenty two weed species i.e. Brassica kaber, Portulaca oleracea, Anagallis arvensis, Ipomea cairica, Melilotus indica, Amaranthus ascendens, Capsella bursa- pastoris, Corchorus olitorius, Emex spinosus, Chenopodium bifo- roxb, Lathyrus hirsutus, Rumex den- tatus and convolvulus arvensis as broad-leave weeds and Polygopp monspelie.n.s, Setaria viridis, Phalaris minor, Echinocloa colonum, Brachiaria repans, Poa annua, Avena fatua, Lolium temulentum, Digitaria songanulis and Dactylotenium egyptiut as grassy weeds. The preeminent weed species were Emex spinosus (64 seeds), Portulaca oleracea (43 seeds), Phalaris minor (43 seeds), Digitaria songanulis (23 seeds), Chenopodium bifo- roxb (20 seeds) and Poa annua (15 seeds).

Table 8, in 1, 2, 3, 4, 5, 6, 7, 8 and 9 zigzag shape, there were the presented twenty five weed species i.e. Brassica kaber, Portulaca oleracea, Anagallis arvensis, Ipomea cairica, Melilotus indica, Amaranthus ascendens, Capsella bursa- pastoris, Corchorus olitorius, Emex spinosus, Chenopodium bifo- roxb, Lathyrus hirsutus, Rumex den- tatus, Cichorium endivia, Medicago polymorpha and convolvulus arvensis as broad-leave weeds and Polygopp monspelie.n.s, Setaria viridis, Phalaris minor, Echinocloa colonum, Brachiaria repans, Poa annua, Avena fatua, Lolium temulentum, Digitaria songanulis, Phalaris paradoxa, Polygopp monspelins, Setaria viridis, Digitaria songanulis and Dactylotenium egyptiut as grassy weeds. The preeminent weed species were Emex spinosus (72 seeds), Portulaca oleracea (47 seeds), Phalaris minor (41 seeds), Chenopodium bifo- roxb (39 seeds), Digitaria songanulis (24 seeds), Lolium temulentum (18 seeds), Echinochloa colonum (14 seeds), Melilotus indica (14 seeds) and Poa annua (11 seeds).
Table 5
Number of seed weeds species/0.5 kg soil in the Ismailia research farm station soil samples 2017 season and 2018 seasons.

| Serial | Soil samples 2017 season | Number of soil samples | Scientific name | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Sum. | Av. | Seed index | LSD at 5% |
|--------|--------------------------|------------------------|----------------|---|---|---|---|---|---|---|---|----|-----|-----|-------------|---------|
| 1      | Cichorium endivia         | 4 a                    | 3.3 a          | 1 a | 1 | 1 | 0.11 | 0.23 | 0.57 |   |    |    |     |    |             |         |
| 2      | Melilotus indica         | 4 a                    | 3.3 a          | 2.6 a | 9.9 | 1.1 | 3.24 | 1.58 |   |    |    |     |    |             |         |
| 3      | Polypogon mosspeil.e.ne  | 2 a                    | 1.6ab          | 1.3ab | 1.3ab | 1.1b | 7.2 | 1.63 | 0.99 |   |    |    |     |    |             |         |
| 4      | Setaria viridis          | 2.6 a                  | 1.3b           | 2 b | 6.6 | 0.73 | 1.49 | 1.09 |   |    |    |     |    |             |         |
| 5      | Brassica kaber           | 17.3a                  | 4.6bc          | 5.6bc | 3.3c | 5.6bc | 7.3b | 49.3 | 5.47 | 11.15 | 2.64 |   |             |         |
| 6      | Portulaca oleracea       | 7.3a                   | 7.3a           | 3.3b | 17.9 | 1.98 | 4.05 | 2.06 |   |    |    |     |    |             |         |
| 7      | Anagallis arvensis       | 13.3a                  | 13.3a          | 3.3c | 5.6bc | 3.3c | 5 bc | 7b | 50.8 | 5.64 | 11.49 | 2.83 |   |             |         |
| 8      | Phalaris minor           | 7.3a                   | 6.3a           | 2.3b | 1.6bc | 1c | 9.9 | 1.1 | 2.24 | 0.93 |   |    |             |         |
| 9      | Echinocloa colonum       | 5 a                    | 2.3a           | 3.3a | 3.3a | 6.6 | 0.73 | 1.49 | 1.23 |   |    |    |     |    |             |         |
| 10     | Amaranthus ascendens     | 1.3b                   | 2b             | 3.6a | 6.9 | 0.76 | 1.56 | 1.09 |   |    |    |     |    |             |         |
| 11     | Lathyrus hirsutus        | 0.6a                   | 1 a            | 2.6 | 0.28 | 0.59 | 0.66 |   |    |    |    |    |    |             |         |
| 12     | Capsella bursa- pastoris| 5 a                    | 3.3a           | 3.3a | 3.3a | 6.6 | 0.73 | 1.49 | 1.23 |   |    |    |     |    |             |         |
| 13     | Corchorus olitorius      | 3.3b                   | 7.3a           | 10.6 | 1.17 | 2.40 | 1.68 |   |    |    |    |    |    |             |         |
| 14     | Rumex dentatus           | 1.3a                   | 1.3a           | 6.2 | 0.35 | 0.72 | 0.57 |   |    |    |     |    |    |             |         |
| 15     | Ipomea caicrica.         | 4.3d                   | 11abc          | 12abc | 8.6bc | 8 cd | 11abc | 7.3 c | 12abc | 13.3a | 78.5 | 8.72 | 17.75 | 3.93 |   |             |         |
| 16     | Emex spinosus            | 5 a                    | 4.3a           | 14.3 | 1.58 | 3.23 | 1.74 |   |    |    |     |    |    |             |         |
| 17     | Brachiaria repans        | 6 a                    | 3.3a           | 3.3a | 3.3a | 6.6 | 0.73 | 1.49 | 1.23 |   |    |    |     |    |             |         |
| 18     | Phalaris parodana        | 7.3a                   | 7.3a           | 3.3a | 3.3a | 6.6 | 0.73 | 1.49 | 1.23 |   |    |    |     |    |             |         |
| 19     | Conchris biflorus roxb.  | 12.3a                  | 7.6b           | 6.6b | 13.3a | 39.8 | 4.42 | 9.00 | 2.38 |   |    |    |     |    |             |         |
| 20     | Poa annua               | 8 a                    | 7.3a           | 1b  | 16.3 | 1.81 | 3.69 | 2.16 |   |    |    |     |    |             |         |
| 21     | Digitaria sanguinalis    | 7b                     | 15.6a          | 22.6 | 2.51 | 5.11 | 1.32 |   |    |    |     |    |    |             |         |
| 22     | Dactylolobenum aegyptius | 5.3a                   | 4b             | 9.3 | 1.03 | 2.10 | 1.04 |   |    |    |     |    |    |             |         |

Mean followed by the same letters within each column do not differ significantly according to Duncan’s Multiple Range test at the 5%.

4. Discussion

The results explained that the dynamics Weed Seed Bank; Seed banks are generally composed of numerous species belonging to three groups. The first group includes dominant species accounting for 70–90% of the total seed bank. These species represent most of the weed problems in a cropping system. Second group of species comprise of 10–20% of the seed bank, including those adapted to
Table 6
The presented weed species and number of seeds into 0.5 kg soil of three zigzag shapes at Ismailia station 2017 and 2018 seasons.

| Ismailia station 2017 | N. of samples | Polypogon monspeliensis | Setaria viridis | Brachiaria minor | Echinochloa colonum | Amaranthus ascendens | Lathyrus hirsutus | Capsella bursa-pastoris | Corchorus olitorius | Emex spinosus | Brachystegia spiciformis | Convolvulus bileensis roxb | Poa annua | Avena fatua | Lolium temulentum | Convolvulus arvensis | Rumex dentatus | Ipomoea cairica |
|-----------------------|----------------|--------------------------|----------------|----------------|-------------------|-------------------|----------------|--------------------------|--------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| 3                     | 2.00           | 4.66                     | 11.50          | 6.30           | 5.00              |                    |                |                          | 12.00              | 7.60           | 7.33            | 12.10          | 3.30           | 5.00           | 12.00          | 7.00           | 8.33           | 20.90          |
| 7                     | 1.30           | 5.66                     | 3.33           | 3.30           | 1.60              |                    |                |                          | 7.33               | 5.00           | 1.00            | 12.30          | 2.30           | 3.30           | 6.30           | 0.66           | 19.60          | 3.30            |
| Total                 | 3.30           | 2.33                     | 23.60          | 6.30           | 7.60              |                    | 3.60           |                          | 1.30               | 3.30           | 5.00            | 12.30          | 3.30           | 5.00           | 12.00          | 7.00           | 8.33           | 20.90          |

Table 7
The presented weed species and number of seeds into 0.5 kg soil of six zigzag shapes at Ismailia station 2017 and 2018 seasons.

| Ismailia station 2017 | N. of samples | Polypogon monspeliensis | SETARIA VIRIDIS | Brassica minor | Portulaca oleracea | Anagallis arvensis | Phalacrus minor | Echinochloa colonum | Amaranthus ascendens | Lathyrus hirsutus | Capsella bursa-pastoris | Corchorus olitorius | Emex spinosus | Brachystegia spiciformis | Convolvulus bileensis roxb | Poa annua | Avena fatua | Lolium temulentum | Convolvulus arvensis | Rumex dentatus | Ipomoea cairica |
|-----------------------|----------------|--------------------------|----------------|----------------|-------------------|-----------------|----------------|-------------------|-------------------|----------------|--------------------------|----------------|----------------|----------------|----------------|----------------|----------------|
| 2                     | 2.00           | 4.66                     | 11.50          | 6.30           | 5.00              |                    |                |                    | 12.00              | 7.60           | 7.33            | 12.10          | 3.30           | 5.00           | 12.00          | 7.00           | 8.33           | 20.90          |
| 3                     | 1.60           | 5.60                     | 3.30           | 1.00           |                    |                    |                |                    | 1.00               | 3.60           | 1.30            | 3.30           | 1.30           | 3.30           | 6.30           | 0.66           | 19.60          | 3.30            |
| 5                     | 1.30           | 5.60                     | 5.60           | 1.00           | 2.00              |                    |                |                    | 1.00               | 3.60           | 1.30            | 3.30           | 1.30           | 3.30           | 6.30           | 0.66           | 19.60          | 3.30            |
| Total                 | 3.30           | 2.33                     | 23.60          | 6.30           | 7.60              |                    | 3.60           |                          | 1.30               | 3.30           | 5.00            | 12.30          | 3.30           | 5.00           | 12.00          | 7.00           | 8.33           | 20.90          |

| Ismailia station 2018 | N. of samples | Polypogon monspeliensis | SETARIA VIRIDIS | Brassica minor | Portulaca oleracea | Anagallis arvensis | Phalacrus minor | Echinochloa colonum | Amaranthus ascendens | Lathyrus hirsutus | Capsella bursa-pastoris | Corchorus olitorius | Emex spinosus | Brachystegia spiciformis | Convolvulus bileensis roxb | Poa annua | Avena fatua | Lolium temulentum | Convolvulus arvensis | Rumex dentatus | Ipomoea cairica |
|-----------------------|----------------|--------------------------|----------------|----------------|-------------------|-----------------|----------------|-------------------|-------------------|----------------|--------------------------|----------------|----------------|----------------|----------------|----------------|----------------|
| 2                     | 2.00           | 4.66                     | 11.50          | 6.30           | 5.00              |                    |                |                    | 12.00              | 7.60           | 7.33            | 12.10          | 3.30           | 5.00           | 12.00          | 7.00           | 8.33           | 20.90          |
| 3                     | 1.60           | 5.60                     | 3.30           | 1.00           |                    |                    |                |                    | 1.00               | 3.60           | 1.30            | 3.30           | 1.30           | 3.30           | 6.30           | 0.66           | 19.60          | 3.30            |
| 5                     | 1.30           | 5.60                     | 5.60           | 1.00           | 2.00              |                    |                |                    | 1.00               | 3.60           | 1.30            | 3.30           | 1.30           | 3.30           | 6.30           | 0.66           | 19.60          | 3.30            |
| Total                 | 3.30           | 2.33                     | 23.60          | 6.30           | 7.60              |                    | 3.60           |                          | 1.30               | 3.30           | 5.00            | 12.30          | 3.30           | 5.00           | 12.00          | 7.00           | 8.33           | 20.90          |
Table 8

| N. of samples | Poa | Avena | Lolium | Convolvulus | Rumex | Ipomea | Digitaria | Dactyloctenium | Cichorium | Melilotus | Phalaris | Medicago |
|---------------|-----|-------|--------|-------------|-------|--------|-----------|---------------|-----------|----------|----------|---------|
| Ismailia station 2017 | 2   | 2     | 0.5    | 1.30        | 6.9   | 1.3    | 5.3       | 2.0           | 2.0       | 0.6      | 5.0      | 3.3     |
| Ismailia station 2018 | 2   | 2     | 0.5    | 1.30        | 6.9   | 1.3    | 5.3       | 2.0           | 2.0       | 0.6      | 5.0      | 3.3     |

The presented weed species and number of seeds into 0.5 kg soil of nine zigzag shapes at Ismailia station 2017 and 2018 season.

5. Conclusion

The number of soil samples to estimate weed seed banks should be either six or nine sites; each sample weighted 0.50 Kg soil with zigzag shape act a direct seed extraction technique to able recognize the abundance of weed species into the soil and their seed density. The aim is to improve integrated weed control.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Data availability

The data that support the findings of this study are available from the corresponding author, upon reasonable request.

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Further Reading

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