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Emergence of a Cover Crop Seed Mix Planted at Three Different Depths

Mary Wolf and Derek Tilley

Cover crop mix emerging from a 1.0 inch (2.5 cm) planting depth. Photo by IDPMC.

ABSTRACT

Cover crop mixes can contain a wide variety of seed sizes, each with different planting depth requirements. This study was conducted to determine which species in a diverse cover crop mix would emerge from drill seeding at three different depths A cover crop mix containing winter pea, winter wheat, winter barley, oilseed radish, hybrid turnip, plantain, and phacelia was drilled at 0.5, 1.0, and 1.5 in (1.3, 2.5, and 3.8 cm) depths in a Kimama silt loam at the Aberdeen PMC. At four weeks after planting, the number of plants of each species per foot of row was counted, and percent of expected emergence was calculated. For all species, there was no significant difference in percent of expected emergence between the three depths. However, 30% less phacelia emerged from 1.5 in than from the two shallower depths. In situations with good seedbed preparation, planting depth may be less of a factor for successful emergence. Nevertheless, very small seeds may benefit from alternate seeding techniques when planted as part of a mix.

Mary Wolf, PMC Agronomist; Derek Tilley, PMC Manager. Abereen PMC, 1691A South 2700 West
mary.wolf@usda.gov

INTRODUCTION

Multi-species cover crop seed mixes can vary widely in seed sizes and recommended seeding depths. For example, peas have large seed and should be planted 1 to 3 in (2.5 to 7.6 cm) deep, while small grains (e.g. wheat) have smaller seed and can emerge from 1 to 2 in (2.5 to 5.1 cm). Smaller cover crop seed includes brassicas, which are recommended to be planted at 0.25 to 0.5 in (6.4 to 1.3 cm). Finally, very small seeded species such as phacelia and plantain are planted shallow, 0.20 to 0.25 in (5 to 6.4 cm) (St. John et al., 2017; Green Cover, 2024). Seeds planted at a suboptimal depth may fail to emerge if too deep, or risk predation if too shallow. Aberdeen PMC staff have observed that shallow planting of large-seeded peas can result in seed being placed near the soil surface. Any removal of soil due to irrigation, rainfall, or wind can result in exposed seed at the surface. Exposure does not meet the germination requirements of the seed, and also results in loss of seed to birds and rodents.One suggested solution might be to seed in multiple drill passes on the same field, one for deep and one for shallow depth requirements. However, planting a cover crop field in two passes doubles the expense of fuel and labor required for the planting. Local producers already feel that the expense of planting cover crops can be prohibitive. Another option might be to use seeding equipment that handles different depths in a single pass (Truax), but this equipment is not readily available for agricultural seedings. A one-pass seeding at a depth that works for large and small seeds is the most practical solution to this problem.

The objective of this study was to determine the effects of seeding depth on a cover crop mix containing different-sized seeds of varying seeding depth requirements.

MATERIALS AND METHODS

We created a 7-species cover crop mix consisting of species that have recommended seeding depths from 0.25 in (phacelia, plantain) to up to 3 in (pea). Mix composition is shown in Table 1. The mix was designed with a high percentage of peas, so that they could be observed easily if they were being exposed by erosion or dug up by animals. The mix was designed to have a population of approximately 1 million seeds/ac. We seeded the same mix at three depths: 0.5 in (1.3 cm) (shallow), 1.0 in (2.5 cm) (medium), and 1.5 in (3.8 cm) (deep). The plot layout was a completely randomized design with four replications.

The study was conducted at the Aberdeen PMC on a Kimama silt loam. Soil samples were sent for testing and fertility adjusted with an application of 40 lb N/ac and 50 lb P/ac prior to planting. Fertilizer was broadcast and incorporated, then sprinkler irrigated a total of 1 in to complete incorporation. The cover crop mix was planted with an Almaco (The Almaco Company, Nevada, IA) plot planter with double disk openers at 9.5 in row spacing on 29 August 2024 (a typical time to plant cool-season cover crops in the Aberdeen area). The study was sprinkler irrigated weekly, with a total of 3.5 in applied between planting and evaluation. In the four weeks between planting and evaluation, the plots received 0.94 in of precipitation.

Table 1. Specifications for a cover crop mix planted at three depths at the Aberdeen PMC on 29 August 2024.

		Recommended Depth (in)[1/]		Full Rate	% of	PLS		PLS	Bulk
Species	Variety	Min	Max	lb/ac	Mix	lb/ac	Seeds/lb	Seeds/ac	Seeds/ft
Plantain	Boston	0.2	0.25	8	10	0.8	200,000	160,000	3.1
Phacelia	Super Bee	0.2	0.25	8	10	0.8	225,000	180,000	3.7
Turnip, hybrid	Vivant	0.25	0.5	8	15	1.8	152,000	60,800	1.3
Radish	Jackhammer	0.25	0.5	12	5	0.4	34,200	61,560	1.2
Winter barley	P919 beardless	0.75	2	90	10	9.0	20,000	180,000	3.5
Winter wheat	Gore	0.75	2	112	10	11.2	16,500	184,800	3.7
Winter pea, Austrian, VNS		1	3	120	40[2/]	48	3,600	172,800	3.4
				Totals	100	72		999,960	19.8

[1/]St. John et al. (2017); Green Cover (2024).
[2/]The mix was designed with a high percentage of peas so that they could be observed easily if they were being exposed or dug up.

The cover crop plots were evaluated four weeks after planting, on 26 September when all species had exhibited complete emergence. We counted the number of plants of each species per 6 ft of row in each plot by pulling up and counting all plants in a 3 ft section of two different rows. From this value, we calculated the percent emergence of each species per 1 ft of row based on the known number of seeds planted per ft (Table 1).

Data were checked for normality and heterogeneity before analysis and analyzed with a one-way analysis of variance with an alpha of 0.05 to determine significance.

RESULTS AND DISCUSSION

Based on the percent of expected emergence calculation, it was possible to get greater than 100% of expected emergence because of chance, how the seed was distributed in the seed box and dropped through the drill.

There were no significant differences in percent emergence between planting depths for any of the species evaluated. Means are shown in Table 2.

Table 2. Mean percentages of expected emergence of cover crop species four weeks after planting at the Aberdeen Plant Materials Center. Based on the percent of expected calculation, it was possible to get >100% of expected emergence.

	Percent of Expected Emergence		
Species	Shallow (0.5 in)	Medium (1.0 in)	Deep (1.5 in)
Plantain	93	90	63
Phacelia	96	>100	98
Turnip	81	84	78
Pea	100	89	>100
Radish	>100	>100	>100
Wheat	>100	>100	>100
Barley	>100	>100	>100

While there was no statistical difference in emergence between the three planting depths of plantain, there was roughly 30% less emergence of plantain at the deepest depth. That equates to 30% of the seed cost that was lost. The results indicate that plantain should not be planted at depths greater than 1 in.

At all depths, turnip emergence was about 20% less than expected. This may simply be a result of sampling method combined with the low bulk seeding rate (1.3 seeds/ft); however, radish also had a low bulk seeding rate (1.2 seeds/ft) and had >100% emergence at all depths. It is possible that germination of the turnip seed lot had declined since it was last tested.

We saw very good establishment of peas at all depths. Even where planted at a depth more shallow than recommended (0.5 in), we did not see any evidence of seed becoming exposed at the surface by soil movement or dug up by birds or rodents.

We planted this study into ideal seeding conditions: a well-prepared seedbed that was firm and weed-free. Additionally, we used a precision drill with double disk openers and press wheels. These factors provided very good seed to soil contact. Additionally, prior to planting, we adjusted soil fertility based on a soil test. Irrigation was available and utilized during establishment. The combination of these critical factors led to excellent emergence and establishment, and in this case we found that seeding depth was not as important as we expected.

Growers wishing to plant cover crop mixes at greater depths should consider using a separate seed box with unattached drop tubes (tubes that do not drop into the furrow in between the openers) for very small seeds. Doing so would essentially broadcast the very small seeds outside the furrow, where they are pressed into the soil with the press wheels or imprinters.

CONCLUSION

This study showed that a shallow planting depth may not be critical for cover crop seed mixes that contain both large seed (peas) and very small seed (phacelia and plantain). Emergence was not affected by seeding depth for most of the cover crops evaluated. The emergence of phacelia was reduced by approximately 30% at the greatest depth (1.5 in), but was not reduced at shallower planting depths. These results emphasize the critical importance of careful preparation of the seed bed before planting. Growers concerned about planting too deep for very small seeds should consider an alternative method of small seed delivery.

LITERATURE CITED

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