

MSC Certification Growth Test Protocol



Premium Potting Soils (PPS)

Purposes are to use commonly grown plants as a bioassay to assure that these potting soils: (1) do not contain materials that would prevent the growth and development of plants, (2) will promote plant growth and provide performance greater than standard potting soils. For a potting soil to pass this test, seedling survival must be statistically equal to or greater than for the control soil, and plant dry weight must be statistically equal to or greater than for the control soil.

Materials

Plant species: radish, 'Early Scarlet' (*Raphanus sativus*); tomato, 'Better Boy' (*Lycopersicon esculentum*); and marigold, 'Janie' (*Tagetes patula*).

Pots: Eight (8), 4-inch square (or round) plastic pots per species.

Control potting soil: To assure testing uniformity, the MSC produces and distributes a uniform control sample. Companies wishing to conduct in-house testing should order control media directly from the association (comes in 1-CF bags). The control soil is considered useable for a period of 6 months after the manufacture date. The expiration date is provided on every bag produced. Along with the control soil sample, the purchaser will be issued a set of cards, which include the MSC logo and lot code of bag(s) of control soil sent. This card is to be included in photos taken of plants at the end of all growth tests run for product registration during the 6 month period after control soil production.

Environment: standard greenhouse environment or equivalent. 75-85°F Day / 60-70°F Night.

Procedure

1. All tests will include four pots of test soil and four pots of control soil for each of three (3) test species for a total of 24 test pots. Seeds should be sown and covered exactly as in step 4.
2. Pots should be filled to overflowing and the excess brushed away so that the soil is even with the top of the pot. Pots may be grouped in trays (such as 1020 trays) for ease in handling.
3. All pots should be thoroughly watered prior to sowing to insure adequate moisture.
4. For each of the three test species, place five (5) seeds in each of the four test soil pots and five seeds in each of the 4 control soil pots for a total of 40 seeds per species. Each pot contains only one species of seed. All seeds should be covered with a very light layer of the same fresh soil before testing.

For each species of seeds

Treatment	No. of pots	Seeds/pot
Control Soil	4	5
Test Soil	4	5

5. Pots should be misted using a standard 3-point fogging nozzle. Pots should be misted as needed to insure adequate moisture. Pots may need misting four times daily in summer; less in winter. Misting should occur until seedlings have established. This may be 3 to 5 days for radish, 5 to 7 days for the others.

6. After germination, plants should be watered as needed.

7. Plants should be counted to determine seedling survival. Time will vary depending on season and species grown and could be as early as 5 to 7 days for radish. All plants should be counted 14 days after sowing, with data entered in the form on the tab for Premium Potting Soils, in the file "MSC Data Sheets for Testing Protocols", available on the MSC website (Link: www.mulchandsoil.datasheet.com).

8. Each pot will be thinned to one plant, plants will be grown for a total of four weeks from sowing, and will be watered as needed. Plants should receive no fertilizer.

9. At 4 weeks after sowing, test plants will be compared to controls. Plant dry weights will be taken, with data entered in the form on the tab for Premium Potting Soils, in the file "MSC Data Sheets for Testing Protocols", available on the MSC website (Link: www.mulchandsoil.datasheet.com).

10. Photos: At the end of the growth test, prior to taking plant dry weights, for all species tested, photos are to be taken of a representative plant growing in the test soil and control soil. Each separate photo should include a card showing the MSC logo and control soil lot code, sent with the control soil sample when purchased.

Data Analysis

1. Seedling survival is a test of 2 proportions, using the 99% confidence level, and is automatically calculated, along with the pass/fail determination, from the data entered on the MSC data file. If the proportion surviving in the potting soil is statistically equal to or greater than the control soil, proceed to step 8. If the proportion of seeds surviving in the test soil is statistically lower than the control soil, the test potting soil sample has failed the test.

2. Plant dry weight is a t-test for means separation, using the 0.05 level of alpha (α) for significance, and is automatically calculated, along with the pass/fail determination, from the data entered on the MSC data file.

Pass/Fail

In order to pass the MSC Grow Test for Premium Soils, plant growth in the test potting soil must be equal to or greater than the control soil, for all 3 plant species as follows: (1) plant top dry weights clipped at the soil level must be statistically equal to or greater than the control soil, as determined by the t-test, and (2) seedling survival must be within 99% confidence level of controls, by proportion analysis. For the soil sample to pass the test, results for all 3 plant species must meet the criteria.

The completed data file and photos are to be submitted with the application form for product registration.

MSC Certification Growth Test Protocol



Standard Potting Soils (SPS)

Purposes are to use commonly grown plants as a bioassay to assure that these potting soils: (1) do not contain materials that would prevent the growth and development of plants, (2) will support plant growth. For a potting soil to pass this test, seedling survival must be statistically equal to or greater than for the control soil, and plants grown must produce true leaves.

Materials

Plant species: radish, 'Early Scarlet' (*Raphanus sativus*); tomato, 'Better Boy' (*Lycopersicon esculentum*); and marigold, 'Janie' (*Tagetes patula*).

Pots: Eight (8), 4-inch square (or round) plastic pots per species.

Control potting soil: To assure testing uniformity, the MSC produces and distributes a uniform control sample. Companies wishing to conduct in-house testing should order control media directly from the association (comes in 1-CF bags). The control soil is considered useable for a period of 6 months after the manufacture date. The expiration date is provided on every bag produced. Along with the control soil sample, the purchaser will be issued a set of cards, which include the MSC logo and lot code of bag(s) of control soil sent. This card is to be included in photos taken of plants at the end of all growth tests run for product registration during the 6 month period after control soil production.

Environment: standard greenhouse environment or equivalent. 75-85°F Day / 60-70°F Night.

Procedure

1. All tests will include four pots of test soil and four pots of control soil for each of three (3) test species for a total of 24 test pots. Seeds should be sown and covered exactly as in step 4.
2. Pots should be filled to overflowing and the excess brushed away so that the soil is even with the top of the pot. Pots may be grouped in trays (such as 1020 trays) for ease in handling.
3. All pots should be thoroughly watered prior to sowing to insure adequate moisture.
4. For each of the three test species, place five (5) seeds in each of the four test soil pots and five seeds in each of the 4 control soil pots for a total of 40 seeds per species. Each pot contains only one species of seed. All seeds should be covered with a very light layer of the same fresh soil before testing.

For each species of seeds

Treatment	No. of pots	Seeds/pot
Control Soil	4	5
Test Soil	4	5

5. Pots should be misted using a standard 3-point fogging nozzle. Pots should be misted as needed to insure adequate moisture. Pots may need misting four times daily in summer; less in winter. Misting should occur until seedlings have established. This may be 3 to 5 days for radish, 5 to 7 days for the others.
6. After germination, plants should be watered as needed.
7. Plants should be counted to determine seedling survival. Time will vary depending on season and species grown and could be as early as 5 to 7 days for radish. All plants should be counted 14 days after sowing, with data entered in the form on the tab for Standard Potting Soils, in the file "MSC Data Sheets for Testing Protocols", available on the MSC website (Link: www.mulchandsoil.datasheet.com).

8. Each pot will be thinned to one plant per pot, plants will be grown for a total of four weeks from sowing and will be watered as needed. If plant growth stalls after 4 weeks (fails to produce a set of fully expanded leaves), one application of a 20-10-20 general purpose fertilizer will be made at 200 ppm N. Otherwise, plants should receive no fertilizer.
9. One additional week of growth will be allowed after fertilization to assess if growth will resume.
10. Photos: At the completion of the growth test, for all species tested, photos are to be taken of a representative plant growing in the test soil and control soil. Each separate photo should include a card showing the MSC logo and control soil lot code, sent with the control soil sample when purchased.

Data Analysis

Seedling survival is a test of 2 proportions, using the 99% confidence level, and is automatically calculated, along with the pass/fail determination, from the data entered on the MSC data file. If the proportion surviving in the potting soil is statistically equal to or greater than the control soil, proceed to step 8. If the proportion of seeds surviving in the test soil is statistically lower than the control soil, the potting soil sample will fail the test.

Pass/Fail

If plants of all 3 species in the test soil produce cotyledons and the first set of true leaves, and the seedling survival is within 99% confidence level of controls, by proportion analysis, the test soil will have passed the MSC Grow Test for Standard Potting Soils. If the test soil stalls during the four weeks, but resumes growth after a fertilizer treatment, it will be assumed that the reason for the stall was due to a lack of nutrition and not due to toxicity. For the soil sample to pass the test, results for all 3 plant species must meet the criteria, at which point, this test soil will have passed the Standard Potting Soil Test.

The completed data file and photos are to be submitted with the application form for product registration.

MSC Certification

Growth Test Protocol



Landscape Soils & Soil Amendments (LS/SA)

Purposes are to use commonly grown plants as a bioassay to assure that these soil amendments: (1) do not contain materials that would prevent the growth and development of plants, (2) will support plant growth. For a soil amendment to pass this test, seedling survival must be statistically equal to or greater than for the control soil, and plants grown must produce true leaves.

Materials

Plant species: radish, 'Early Scarlet' (*Raphanus sativus*); tomato, 'Better Boy' (*Lycopersicon esculentum*); and marigold, 'Janie' (*Tagetes patula*).

Pots: Eight (8), 4-inch square (or round) plastic pots per species.

Control potting soil: To assure testing uniformity, the MSC produces and distributes a uniform control sample. Companies wishing to conduct in-house testing should order control media directly from the association (comes in 1-CF bags). The control soil is considered useable for a period of 6 months after the manufacture date. The expiration date is provided on every bag produced. Along with the control soil sample, the purchaser will be issued a set of cards, which include the MSC logo and lot code of bag(s) of control soil sent. This card is to be included in photos taken of plants at the end of all growth tests run for product registration during the 6 month period after control soil production.

Environment: standard greenhouse environment or equivalent. 75-85°F Day / 60-70°F Night.

Procedure

1. The "test soil" for this test shall be the test landscape soil or soil will be pH adjusted in volumetric ratios according to label directions. The test landscape soil or soil amendment will be tested test samples Sample one will be 100% test product). S two same product blended with builder's grade sand in volumetric ratios according to label directions. [The sample product may contain soluble salts that are fine for soil amendments but toxic to young seedlings. The blended product test is designed to dilute these possible high levels of salts. However, the test product may be blended with as much as 50% sand, according to label directions. The blended sample may be too course for good seed germination. Therefore, the tests are run both ways to provide a fair test.]
2. All tests will include four pots of test soil and four pots of control soil for each of three (3) test species for a total of 24 test pots.
3. Pots should be filled to overflowing and the excess brushed away so that the soil is even with the top of the pot. Pots may be grouped in trays (such as 1020 trays) for ease in handling.
4. All pots should be thoroughly watered prior to sowing to insure adequate moisture.
5. For each of the three test species, place five (5) seeds in each of the four test soil pots and five seeds in each of the 4 control soil pots for a total of 60 seeds per species. Each pot contains only one species of seed. All seeds should be covered with a very light layer of the same fresh soil before testing.

For each species of seeds

Treatment	No. of pots	Seeds/pot
Control Soil	4	5
Test Soil (100%)	4	5
Test Soil (Blended)	4	5

6. Pots should be misted using a standard 3-point fogging nozzle. Pots should be misted as needed to insure adequate moisture. Pots may need misting four times daily in summer; less in winter. Misting should occur until seedlings have established. This may be 3 to 5 days for radish, 5 to 7 days others.
7. After germination, plants should be watered as needed.
8. Plants should be counted to determine seedling survival. Time will vary depending on season and species grown and could be as early as 5 to 7 days for radish.
9. After 14 days, plants should have produced cotyledons and the first set of true leaves. If plant growth stalls after 2 weeks (fails 14 days, the plants fail to produce a set of fully expanded leaves), one application of a 20-10-20 general purpose fertilizer will be made at 200 ppm N. Otherwise, plants should receive no fertilizer.
10. Two additional weeks of growth will be allowed after fertilization to assess if growth will resume. in both test soils and the control soil (three total). Each separate photo should include a card showing the MSC logo and control soil lot code, sent with the control soil sample when purchased.

Data Analysis

Seedling survival numbers of the test soil are compared to controls ns a test of 2 proportions, using the 99% confidence level, and is automatically calculated, along with the pass/fail determination, from the data entered on the MSC data file. If the proportion surviving in the potting soil is statistically equal to or greater than the control soil, proceed to step 9. If the proportion of seeds surviving in the test soil is statistically lower than the control soil, the test soil has failed the test. A pass/fail chart was developed for comparison.

Pass/Fail

If plants of all 3 species in the test soil produce cotyledons and the first set of true leaves, and the seedling survival is within 99% confidence level of controls, by proportion analysis, number of these seedlings match the provided chart, the test soil will have passed the MSC Toxicity Test for Landscape Soils and Soil Amendments. Only one of the two test soils (100% or blended) needs to pass. If the test soil stalls during the two weeks, but resumes growth after a fertilizer treatment, it will be assumed that the reason for the stall was due to a lack of nutrition and not due to toxicity. For the soil sample to pass the test, results for all 3 plant species must meet the criteria, at which point, this soil will have passed the test. The completed data file and photos are to be submitted with the application form for product registration.

<u>Control</u>	<u>Test Mix</u>
If Control Count	Number needed
Number is:	to pass is:
20	15
19	14
18	12
17	11
16	10
15	9
14	8

MSC Certification Growth Test Protocol



Special Purpose: Seed Starter Potting Soil

Purposes are to use commonly grown plants as a bioassay to assure that these potting soils: (1) do not contain materials that would prevent the growth and development of plants, (2) will support the germination and establishment of young seedlings. For a potting soil to pass this test, seedling survival must be statistically equal to or greater than for the control soil, and plants grown must produce true leaves.

Materials

Plant species: Radish, 'Early Scarlet' (*Raphanus sativus*); Tomato, 'Better Boy' (*Lycopersicon esculentum*); Marigold, 'Janie' (*Tagetes patula*); Basil, 'Sweet Green' (*Ocimum basilicum*); Impatiens 'Dazzler Red' (*Impatiens walleriana*); and Zinnia "Dreamland Red" (*Zinnia elegans*).

Pots: Eight (8), 4-inch square (or round) plastic pots per species.

Control potting soil: To assure testing uniformity, the MSC produces and distributes a uniform control sample. Companies wishing to conduct in-house testing should order control media directly from the association (comes in 1-CF bags). The control soil is considered useable for a period of 6 months after the manufacture date. The expiration date is provided on every bag produced. Along with the control soil sample, the purchaser will be issued a set of cards, which include the MSC logo and lot code of bag(s) of control soil sent. This card is to be included in photos taken of plants at the end of all growth tests run for product registration during the 6 month period after control soil production.

Environment: standard greenhouse environment or equivalent. 75-85°F Day / 60-70°F Night.

Procedure

1. All tests will include four pots of test soil and four pots of control soil for each of six test species for a total of 48 test pots. Seeds should be sown and covered exactly as in step 4.
2. Pots should be filled to overflowing and the excess brushed away so that the soil is even with the top of the pot. Pots may be grouped in trays (such as 1020 trays) for ease in handling.
3. All pots should be thoroughly watered prior to sowing to insure adequate moisture.
4. For each of the six test species, place five (5) seeds in each of the four test soil pots and five seeds in each of the 4 control soil pots for a total of 40 seeds per species. Each pot contains only one species of seed. All seeds should be covered with a very light layer of the same fresh soil before testing.

For each species of seeds

Treatment	No. of pots	Seeds/pot
Control Soil	4	5
Test Soil	4	5

5. Pots should be misted using a standard 3-point fogging nozzle. Pots should be misted as needed to insure adequate moisture. Pots may need misting four times daily in summer; less in winter. Misting should occur until seedlings have established. This may be 3 to 5 days for radish, 5 to 7 days for the others.
6. After germination, plants should be watered as needed.
7. Plants should be counted to determine seedling survival. Time will vary depending on season and species grown, and could be as early as 5 to 7 days for radish. All plants should be counted 14 days after sowing, with data entered in the form on the tab for Seed Starter Potting Soils, in the file "MSC Data

Sheets for Testing Protocols”, available on the MSC website (Link: www.mulchandsoil.datasheet.com).

8. Each pot will be thinned to one plant. Plants will be grown for a total of four weeks from sowing. Plants will be watered as needed but should receive no fertilizer.

9. Photos: At the completion of the growth test, for all species tested, photos are to be taken of a representative plant growing in the test soil and control soil. Each separate photo should include a card showing the MSC logo and control soil lot code, sent with the control soil sample when purchased.

Data Analysis

Seedling survival is a test of 2 proportions, using the 95% confidence level, and is automatically calculated, along with the pass/fail determination, from the data entered on the MSC data file. If the proportion surviving in the potting soil is statistically equal to or greater than the control soil, proceed to step 8. If the proportion of seeds surviving in the test soil is below the control soil, the potting soil sample will fail the test.

Pass/Fail

If plants of all 6 species in the test soil produce cotyledons and the first set of true leaves, and the seedling survival is within 95% confidence level of controls, by proportion analysis, the test soil will have passed the MSC Grow Test for Seed Starter Soils.

The completed data file and photos are to be submitted with the application form for product registration.