

## SECOND YEAR TRANSPLANT SURVIVAL ON CONSTRUCTED TEST PLOTS, QUESTA MINE, QUESTA, NEW MEXICO<sup>1</sup>

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**Extended Abstract.** Molycorp, Inc. (Molycorp) Questa Mine is located approximately 5.6 kilometers east of the Village of Questa, New Mexico at an elevation ranging from 2,440 to 3,050 meters. In 2003, Molycorp established an extensive test plot program to evaluate revegetation of the mine's rock piles. This test plot program included the construction of replicates of three test plot designs representing three (3) different slope classes: 1) 2:1 slopes, 2) 3:1 slopes, and 3) flat slopes. The test plots were designed to evaluate the effects of cover soil depth, soil amendments, seeding techniques, and planting rates on revegetation success.

Each of the test plot designs received three (3) soil cover treatments; no cover, 30 cm, and 90 cm of cover soil material. Depending on the slope, various soil amendments were incorporated into each of the three cover soil material treatments. These soil amendments included: control (no soil amendment), mycorrhizal inoculant (forest soil) (1,120 kg/ha), and fertilizer (67 kg P<sub>2</sub>O<sub>5</sub>/ha) treatments. All three soil amendment treatments were applied to the flat sloped plots, while only the control and mycorrhizal inoculant treatments were applied to the sloped plots.

Once the soil amendments were incorporated into the cover soil material, the plots were seeded and hydro-mulched. The flat sloped test plots received two seeding treatments, drill seeding and hydro-seeding. The sloped test plots were hydroseeded only.

**Additional Key Words:** Revegetation, reforestation, high altitude reclamation, transplant establishment, soil amendments, inoculant, and cover soil depth.

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In the fall of 2003, approximately 27,000 tree and shrub seedlings were transplanted. The seedlings were grouped into three seedling classes based on their reclamation purpose. These classes included: nurse species, crop species, and shrub species. The nurse species consisted of fast growing species, such as narrow-leaf cottonwood and New Mexico locust, which would overtime provide shade and wind cover for the crop trees. The crop species consisted of conifers which represents the post mining land use target community. Various shrubs were planted for understory cover and wildlife habitat. The tree and shrub seedlings were planted using two planting rate treatments, an 'A' planting rate (1,510 nurse species trees/ha) and a 'B' planting rate (2,115 nurse species trees/ha). The seedlings on the flat sloped test plots were transplanted at the 'A' planting rate. Seedlings on the sloped test plots were transplanted at both the 'A' and 'B' planting rates.

Seedling survival was determined by either a total population count or a sample estimate of live seedlings. Seedling percent survival means and standard deviations, as well as statistical comparisons, were calculated for each test plot design and the various subplots.

The mean percent seedling survival on the 2:1 test plot was 65.5%(SD 24.7) (Table 1). The mean percent survival for the seedlings on the three cover soil depths (0 cm, 30 cm, and 90 cm) was 52.2%(SD 32.3), 73.8% (SD 14.7), and 70.7% (SD 18.4), respectively (Table 1). The seedlings on the control and inoculated soil amendments had a mean percent survival of 62.6% (SD 25.4) and 68.5% (SD 23.9), respectively (Table 1). The 'A' and 'B' planting rates had mean percent survivals of 66.9% (SD 23.5) and 64.2% (SD 26.1, respectively (Table 1).

Seedling survival on the 3:1 test plots had a mean percent survival of 60.6% (SD 23.4) (Table 2). The mean percent survival for the seedlings on the three cover soil depths (0 cm, 30 cm, and 90 cm) was 40.9% (SD 24.4), 72.3% (SD 15.8), and 68.6% (SD 15.0), respectively (Table 2). The seedlings on the control and inoculated soil amendments had a mean percent survival of 58.6% (SD 23.1) and 62.6% (SD 23.8), respectively (Table 2). The 'A' and 'B' planting rates had mean percent survivals of 60.6% (SD 21.5) and 60.6% (SD 25.5), respectively (Table 2).

Seedling survival on the flat slope test plots had a mean percent survival of 60.2% (SD 20.8) (Table 3). The mean percent survival for the seedlings on the three cover soil depths (0 cm, 30 cm, and 90 cm) was 44.8% (SD 27.8), 69.9% (SD 14.6), and 66.0% (SD 14.3), respectively (Table 3). The seedlings on the control, inoculated and fertilizer soil amendments had a mean percent survival of 59.1% (SD 20.4), 59.9% (SD 24.3) and 61.7% (SD 23.5), respectively (Table 3). The drill and hydro seeding treatments had mean percent survivals of 59.6% (SD 21.6) and 60.9% (SD 23.8), respectively (Table 3).

These data represent the second year survival and should be considered preliminary. Long-term treatment effects may differ from the early survival rates. These preliminary results show that 90 cm of cover soil does not provide additional benefits with respect to survival. The forest soil inoculant shows some benefit, while the use of fertilizer does not. Overall second year survival was nearly 62% for all treatments.

Table 1. 2:1 Test Plot Mean Percent Survivals, Questa Mine, New Mexico, 2006.

	<b>Survival (%)</b>	<b>Standard Deviation</b>
2:1 Test Plots	65.6	24.7
Cover Soil Material Depth Treatment		
0 cm Cover	52.2	32.3
30 cm Cover	73.8	14.7
90 cm Cover	70.7	18.4
Soil Amendment Treatments		
Control	62.6	25.4
Inoculant	68.5	23.9
Planting Rate Treatments		
'A' Planting Rate	66.9	23.5
'B' planting Rate	64.2	26.1

Table 2. 3:1 Test Plot Mean Percent Survivals, Questa Mine, New Mexico, 2006.

	<b>Survival (%)</b>	<b>Standard Deviation</b>
3:1 Test Plots	60.6	23.4
Cover Soil Material Depth Treatment		
0 cm Cover	40.9	24.4
30 cm Cover	72.3	15.8
90 cm Cover	68.6	15.0
Soil Amendment Treatments		
Control	58.6	23.1
Inoculant	62.6	23.8
Planting Rate Treatments		
'A' Planting Rate	60.6	21.5
'B' planting Rate	60.6	25.5

Table 3. Flat Slope Test Plot Mean Percent Survivals, Questa Mine, New Mexico, 2006.

	<b>Survival (%)</b>	<b>Standard Deviation</b>
Platform Test Plots	60.2	20.8
Cover Soil Material Depth Treatment		
0 cm Cover	44.8	27.8
30 cm Cover	69.9	14.6
90 cm Cover	66.0	14.3
Soil Amendment Treatments		
Control	59.1	20.4
Inoculant	59.9	24.3
Fertilizer	61.7	23.5
Seeding Treatments		
Drill Seeding	59.6	21.6
Hydro-seeding	60.9	23.8