SOIL PREPARATION PRACTICES TO ELIMINATE SOIL RESTRICTIONS TO GRAPEVINE ROOT DISTRIBUTION FOR THE ESTABLISHMENT OF SUSTAINABLE VINEYARDS.

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Abstract:

Context and purpose of study - Grapevine yield and wine quality are dependent on good quality vegetative growth and root development. Soils that restrict proper grapevine root development, together with the high cost of establishing a new vineyard, require effective soil preparation to sustain productive vineyards for 25 years. This study reviews soil preparation research conducted over the past 50 years and identifies best practices to remove soil physical and chemical impediments to create optimum conditions for root growth.

Material and methods - In a series of field trials in vineyards, different implements namely rippers, various types of delve ploughs, excavators, as well as different tillage depths and soil types were investigated. The effect of soil preparation was measured in terms of and root growth and above-ground grapevine performance, penetrometer resistance and the longevity of soil profile modification.

Results - A reduction in available soil volume decreases the grapevine root system and subsequently also shoot growth and yield. The first sign of soil compaction is uneven growth which may eventually progress to dead patches in a vineyard. Results showed that the soil must be loosened to a depth of at least 800 mm, but preferably to one meter. Adequate soil depth could compensate for lack of irrigation in the coastal region of the Western Cape.

The correct choice of implement for soil preparation is determined by soil type. The South African wine and table grape industries have access to an array of implements that can deal effectively with diverse soil conditions. Effective soil preparation means that the soil is uniformly loosened to a depth of at least 800 mm, that poor subsoil is not brought to the surface and that the loose soil has a good structure *i.e.* no large clods which cannot be exploited by roots.Soil water content determines to a large extent the effectiveness of implement action. Soils that are too dry break up in large clods and require maximum draw power. Soils that are too wet when tilled, result in poor crumbling and wheel slip. Conditions for preparation are best when the soil surface is dry to ensure good traction for tractors while the subsoil is still moist.

Deep tillage in two directions may be necessary when a uniformly loose medium is not achieved with working in one direction or better mixing is required. The application of soil ameliorants during soil preparation is essential. This practice provides the only opportunity to apply lime on acid soils, remedy low P contents in the subsoil and also incorporate gypsum in the subsoil for the reclamation of saline soils. Loose soil re-compact after soil preparation and such re-compaction is especially harmful in newly planted vineyards. Results on the longevity of soil preparation before re-compaction occurs, are presented.

Keywords: soil preparation; soil depth; ameliorants; re-compaction; root distribution; grapevine performance

1. Introduction.

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Introduction & Objective

Soils that restrict proper grapevine root development together with the high cost of establishing a new vineyard, require effective soil preparation to sustain productive vineyards for 25 years. This study reviews soil preparation research conducted over the past 50 years which are combined in a book format and identifies best practices to remove soil physical and chemical impediments to create optimum conditions for root growth.

A delve plough

A ripper plough

Materials and Methods

In a series of field trials in vineyards, different implements namely rippers, various types of delve ploughs, excavators, as well as different tillage depths and soil types were investigated. The effect of soil preparation was measured in terms of and root growth and above-ground grapevine performance, penetrometer resistance and the longevity of soil profile modification.

Soil preparation effect on Root Growth

Soil preparation leads to a decline in bulk density and an increase in dry root mass as illustrated in Figure 1. The effect is enhanced with the incorporation of lime into the subsoil.

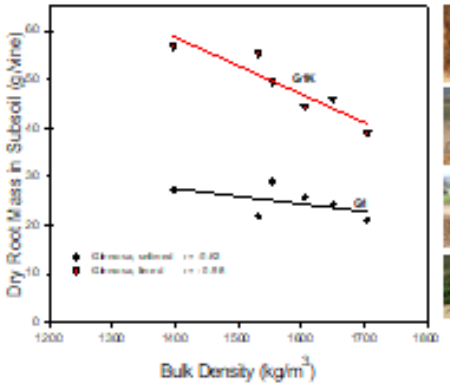

Figure 1. The effect of liming and soil compaction on dry root mass.

Soil preparation effect on cumulative yield

The long term effect and depth of deep soil preparation on cumulative yield are illustrated in Figure 2. The soil preparation method with the most disturbance (Delve plough) has the largest cumulative yield increase over time.

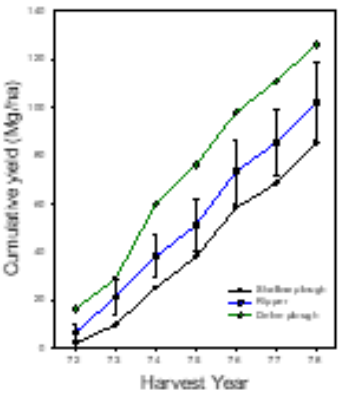

Figure 2. The effect of deep tillage on cumulative yield over time

Conclusion

These results clearly showed that the application of soil ameliorants during soil preparation is essential. The deeper and more aggressive the deep soil preparation, the better the longevity of the vine orchard in terms of yield and vegetative growth.

Acknowledgments

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