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Application of Precision Agricultural Techniques to Florida's Mineral Soils[1]

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The extremely high variability presented by mineral soils (Spodosols) in Florida warrants special attention be given to fields, especially regarding fertilization management for profitable and sustainable production of crops such as citrus, vegetables, and sugarcane. Florida agricultural lands present localized areas of very low production, adjacent to areas of very high production. Areas of reduced yields can be extensive and comprise up to 25% of a given field. The causes for these yield depressions are not thoroughly known, but among the suspected factors are water stress, low organic matter content, and low soil fertility. Through studies performed on sugarcane, the author has determined that soils from poorly producing areas normally present low contents of organic matter, pH, calcium, and silicon and fewer microbial populations. Mapping and soil analyses by grid sampling have allowed construction of a number of contour maps of various soil characteristics for a number of sugarcane fields. These maps have provided useful information on actual variability within site specific areas.

With knowledge of characteristics of low yielding areas and the availability of accurate maps, application of site-specific corrective treatments is now possible. New technologies such as precision agriculture could allow growers to have a more cost-effective and environmentally friendly production system.

Within the past 20 years, precision agriculture has provided new management tools that allow for the implementation of Variable Rate Technology (VRT) for fertilizers and other soil amendments. The use of precision farming techniques can allow Florida growers to increase yield and/or production efficiency by maintaining or lowering costs. When resources are limited, determining the soil chemical status for specific areas will permit better resource allocation and differential application. For instance, growers usually have limited budgets for liming and fertilization of fields. If a grower's budget only permits liming at 4.0 ton/a, the total quantity of lime for a 40 acre field may be distributed so that areas presenting lower pH may receive 6.0 ton/a, whereas areas with pH 7.0 or higher receive little or no lime at all. The same principle holds for fertilizer, organic amendments and pesticide application. A more uniform productivity for mineral soils and higher overall yields are expected with the use of adequate

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amendments and precision agriculture techniques to target those areas mapped as low-yielding.

Remote sensing (RS), global positioning systems (GPS), geographic information systems (GIS), and yield monitoring can identify crop-stressed areas in a field. In the specific case of sandland crops, by monitoring the “problem” sites according to their geographical coordinates, we are able to detect the changes caused by soil amendments, tissue characteristics, and production data and make future modifications to amendment rates/types based on this information.

The main focus of Precision Agriculture has been on identifying temporal and spatial variability in production fields and on developing management practices that will allow the best site-specific management of production processes.

Quantifying field variability enables the identification of areas with high production potential, justifying greater investments for maximizing productivity. In areas with lower production potential, it may be possible to improve productivity, depending on the characteristics to be corrected and whether it is economically viable. In a situation where corrective measures are not feasible, the areas may be left unamended or be taken out of production, and the grower would be able to use resources in areas of higher production potential.