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A Practical Guide to Biofertilizers for Florida Growers[1]

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This publication discusses what biofertilizers are, how they work, and how to apply them in Florida's cropping systems. The primary audience of this article is Florida growers and Extension personnel.

Sandy soils in Florida hold nutrients and water poorly. Heavy rainfall washes away fertilizers from the root zone and reduces nutrient use efficiency. This forces growers to apply more fertilizer to meet crop demand. Fertilizer prices have continued to rise in recent years, making nutrient inputs one of the biggest expenses for Florida growers (Singerman and Futch 2022). Because much of Florida agriculture is in low-lying areas connected to canals, lakes, and wetlands, fertilizers that are not applied carefully can move off fields and impact nearby water bodies. Therefore, state and federal water conservation and quality rules have become stricter, adding more pressure on how nutrients are managed in the field (Liu et al. 2026). This combination of higher fertilizer costs, Florida's sensitive ecosystems, and challenging soils indicates that nutrient management is more important than ever for keeping farms profitable while also protecting soil and water quality.

One promising approach to address these challenges is the use of biofertilizers. These products contain beneficial microorganisms that can improve nutrient availability and crop growth. In Florida agriculture, biofertilizers are of particular interest because year-round vegetable and fruit production increases nutrient demand, and growers are seeking options that can lower input costs while maintaining yields and protecting soil and water quality. Interest is expanding in the context of vegetable, fruit, and row crop production, where biofertilizers can complement existing fertility practices, support crop vigor, and improve soil health and function under local conditions.

In the United States, biofertilizers are regulated at the state level, and labeling requirements are not uniform. To ensure product reliability, growers should check the microbial count (usually in CFU), expiration date, storage instructions, and state registration number before purchase or use. Because registration standards vary among states, verifying a Florida registration number is particularly important to ensure that the product has undergone the state review process.

What Are Biofertilizers?

Biofertilizers are products that contain living microbes, such as bacteria and fungi, which can help crop growth by fixing nitrogen (N), enhancing phosphorus (P) availability, protecting roots, and improving overall soil health. The key feature of biofertilizers is that the living microorganisms in the products must stay alive through storage and application to work effectively.

Biofertilizers differ from related products in important ways. For example, biostimulants may contain plant extracts or hormones that stimulate plant growth but do not necessarily contain live microbes. Organic fertilizers and composts provide nutrients from decomposed materials but may not contain specific living microorganisms that can improve nutrient use. Biofertilizers are defined by the presence of live microorganisms that may directly help crops access and use nutrients. These differences also affect how products are regulated. For example, biofertilizers must meet microbial viability standards, while organic fertilizers are regulated primarily for nutrient content.

Biofertilizers can be grouped by the type of microbe they contain or by the function they perform in the soil–plant system. Figure 1 shows the main categories of biofertilizers currently available in the U.S. market.

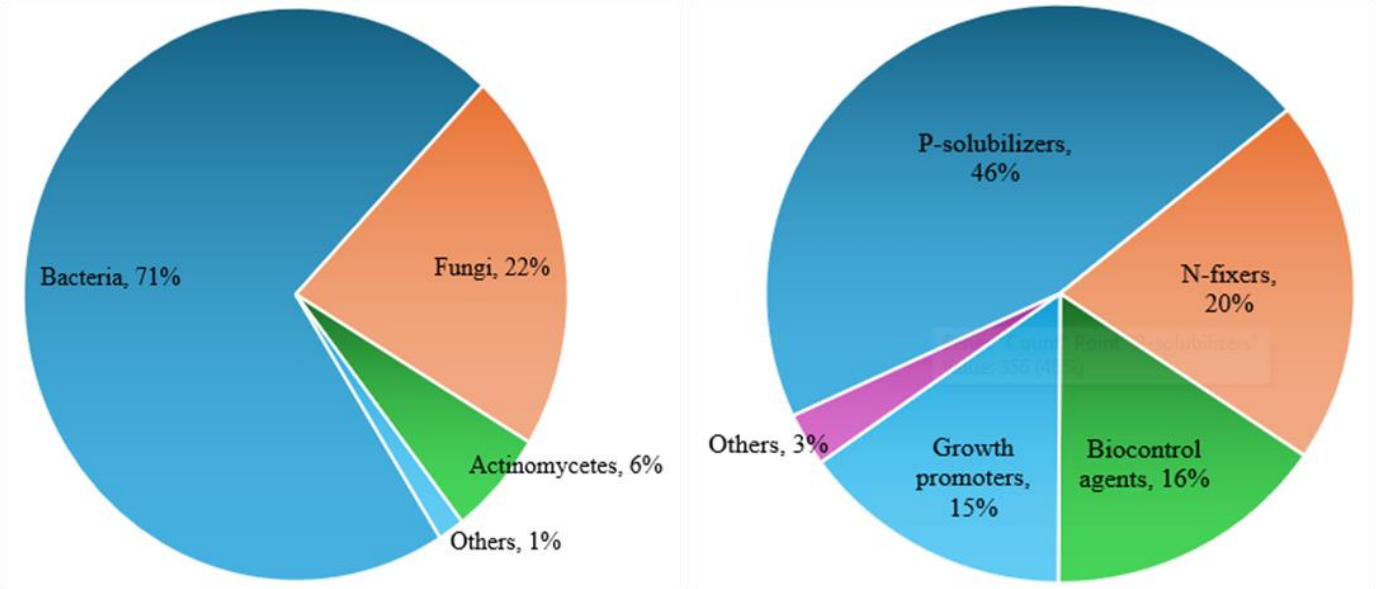


Figure 1. Biofertilizers available in the U.S. market categorized by microbial origin (left) and by function (right). Credit: Suraj Melkani, UF/IFAS.

In Florida, biofertilizers are being explored in several production systems, especially in vegetable crops (Chanda et al. 2024). Results from field trials on broccoli and lettuce demonstrated that biofertilizers can perform well under field conditions, making them an attractive option for growers. In some cases, biofertilizers can increase yields by about 10% to 40% while cutting N and P fertilizer needs by up to 50% and 25%, respectively, depending on crops and growing conditions (Daniel et al. 2022; Demir et al. 2023). When applied within a 4R framework (i.e., right source, rate, time, and place), biofertilizers can help Florida growers maintain crop productivity, lower fertilizer costs, and protect soil health and surrounding water bodies (Johnston and Bruulsema 2014).

How to Apply Biofertilizers

Florida's high temperatures and humidity can quickly kill beneficial microbes in biofertilizers. Products should not be stored in hot sheds or truck beds but in cool, shaded locations. Heat and prolonged storage will reduce effectiveness. Below are several methods of applying biofertilizers.

Seed Treatment

The seed is lightly moistened and coated with the biofertilizer solution, resulting in a thin, even film covering every seed.

Key Points to Consider

- Coating should be applied just before planting.
- Treated seed should be planted the same day for best results.
- Coated seed should be kept cool and shaded until planting.
- Typical rates are about 1% to 2% of seed weight, but specific product labels should always be followed for rate and handling.
- Fungicides or other chemicals should not be mixed unless the product label specifically allows it.

Furrow Application

Biofertilizer is mixed with water, compost, or another carrier and placed directly into planting furrows, root zones, or planting holes before seeding or transplanting. This method ensures early contact between microbes and roots and improves colonization, nutrient uptake, and seedling establishment. It is commonly used for row crops and vegetables at planting.

Key Points to Consider

- Application should be made immediately after mixing.
- Compatibility with other soil amendments should be checked before mixing.
- Product labels should be followed for application rates and dilution.
- Incompatible soil amendments such as high-salt fertilizers or lime should not be mixed without checking the label.
- Highly chlorinated water should not be used because chlorine kills beneficial microbes.

Seedling Root Dipping

Transplants are dipped for a few minutes in biofertilizer solution mixed with clean water, then planted promptly in the field. This helps microbes colonize the rhizosphere, reducing transplant shock and supporting early root growth and disease suppression.

Key Points to Consider

- Solution should be mixed fresh on the day of transplanting.
- Clean, non-chlorinated water should be used.
- Roots should generally be dipped for 2–5 minutes. Specific guidelines provided by the manufacturer should be followed.
- Transplants should be planted immediately after dipping.
- Solution should be kept shaded while working.
- Contaminated water, chlorinated water, and water containing pesticide residues should not be used.
- Mixed solution should not be left sitting in the sun.

Foliar Spray

Diluted biofertilizer can be sprayed directly on leaves. This method allows for rapid uptake of nutrients through leaf surfaces, making it useful for addressing mid-season deficiencies or providing a quick boost during critical growth stages. Foliar applications can complement soil-based treatments and are particularly effective when root uptake is limited by stress or poor soil conditions.

Key Points to Consider

- Application should be made in the early morning or late afternoon when temperatures are cooler.
- Fresh solution should be mixed immediately before spraying.
- Clean, non-chlorinated water should be used.
- Label directions should be followed for dilution rates and tank-mixing.
- Spraying in full sun or midday heat should be avoided.
- Tank-mixing with concentrated copper fungicides, harsh pesticides, or products with extreme pH should not be done unless the label specifically approves it. Hard water or highly chlorinated water should not be used.

Fertigation

Some products can be injected through drip irrigation systems. This approach delivers biofertilizers directly to the root zone along with irrigation water, ensuring consistent distribution and efficient use of the product. Fertigation is well-suited to Florida's widespread use of drip systems in vegetable and fruit production, allowing growers to incorporate biofertilizers into their existing irrigation schedules with minimal additional labor.

Key Points to Consider

- Irrigation systems should be cleaned and flushed regularly to prevent clogging.
- Filtered water should be used to protect microbes and prevent emitter clogging.
- Injection should be done during cooler parts of the day when possible.
- Label instructions should be followed for injection rates and timing.
- High-salt fertilizers, acids, or other harsh chemicals should not be mixed in the same injection unless approved by the label.
- Unfiltered water should not be used.

Benefits for Growers

Lower costs: Biofertilizers may lead to enhanced nutrient efficiency and healthier soils, which can reduce fertilizer demand and lower production costs. For growers, this can translate into savings while also protecting the soil and water that agriculture depends on. However, the extent of cost savings depends on crop type, soil conditions, product performance, and management practices.

Crop productivity: Biofertilizers are generally associated with stronger roots and better access to nutrients, which can support vigorous crop growth. Therefore, growers may see higher yields and better produce quality under favorable conditions.

Nutrient use efficiency: Beneficial microbes can help crops make better use of nutrients already in the soil through several mechanisms. For example, P-solubilizing microbes can release bound P in soils, which can help plants utilize the existing reserves and reduce fertilization demand. N-fixing bacteria can fix atmospheric N and convert it into forms plants can use. This additional nutrient supply can partially fulfill plant N demand. Together, these processes can improve fertilizer efficiency and reduce waste, but the degree of improvement varies by product, soil conditions, and crop requirements.

Soil health: Over time, biofertilizers may support healthier soils. They can improve soil structure, help build stable organic matter that stays in the soil, and can

improve nutrient cycling through natural biological activity. These benefits typically develop gradually and depend on consistent use, compatible management practices, and favorable soil conditions.

Environmental conservation: By improving nutrient efficiency, biofertilizers may help reduce fertilizer runoff and leaching into canals, lakes, and wetlands in systems where fertilizer applications exceed crop demand. Enhanced nutrient use efficiency from these products can lead to improved plant vigor and health, which in turn may reduce pesticide needs in some crops.

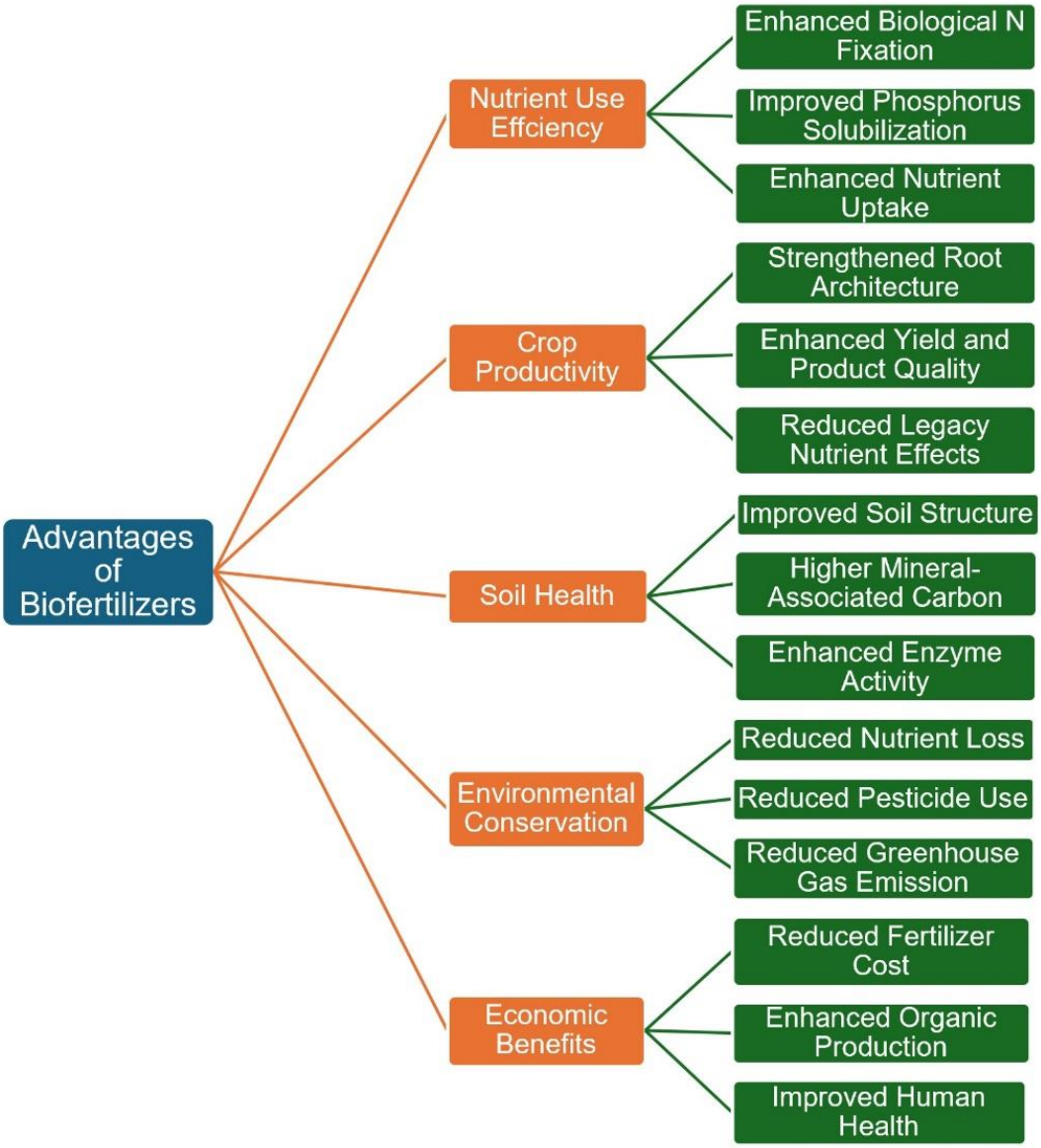


Figure 2. Key benefits of biofertilizers in Florida soils. These include nutrient use efficiency, crop productivity, soil health, environmental conservation, and reduced costs.
Credit: Hamed Arfania, UF/IFAS.

How to Read a Biofertilizer Label

Before purchasing or using any biofertilizers, verify the following aspects.

- **Microbial species listed**: The organisms in the product should be identified.
- **CFU count per unit**: Confirms how many live microbes are present.
- **Expiration date**: Products should be used before they expire.
- **Storage temperature range**: Critical in Florida's hot climate.

- **Application instructions**: Indicate how and when to apply.
- **State registration number**: Confirms the product is approved for use in Florida.

Read the label to confirm the product works as intended. If a label is ambiguous and cannot be interpreted, growers should contact the manufacturer or local Extension agent prior to using the product. The example label (Figure 3) shows the following main items growers should check.

Guaranteed analysis: This section lists the nutrients supplied, such as N, potassium (K_2O), and sulfur (S). Many biofertilizers also include non-plant food ingredients, which are the live microbes. In the example, *Bacillus subtilis* and *Bacillus amyloliquefaciens* are listed, each with a viable count (1.0×10^6 CFU/mL). This confirms what living organisms the product truly contains and how many live, active microbes are in the product. For example, *Bacillus subtilis* and *Bacillus amyloliquefaciens* are the two microbes present in the product (Figure 3), and the number 1.0×10^6 CFU/mL means one million colony-forming units per milliliter. Higher CFU generally indicates a greater concentration of viable, culturable microorganisms in the product.

Derived from: This line shows the chemical sources (e.g., ammonium nitrate and potassium sulfate). It indicates what fertilizers the product includes in addition to microbes.

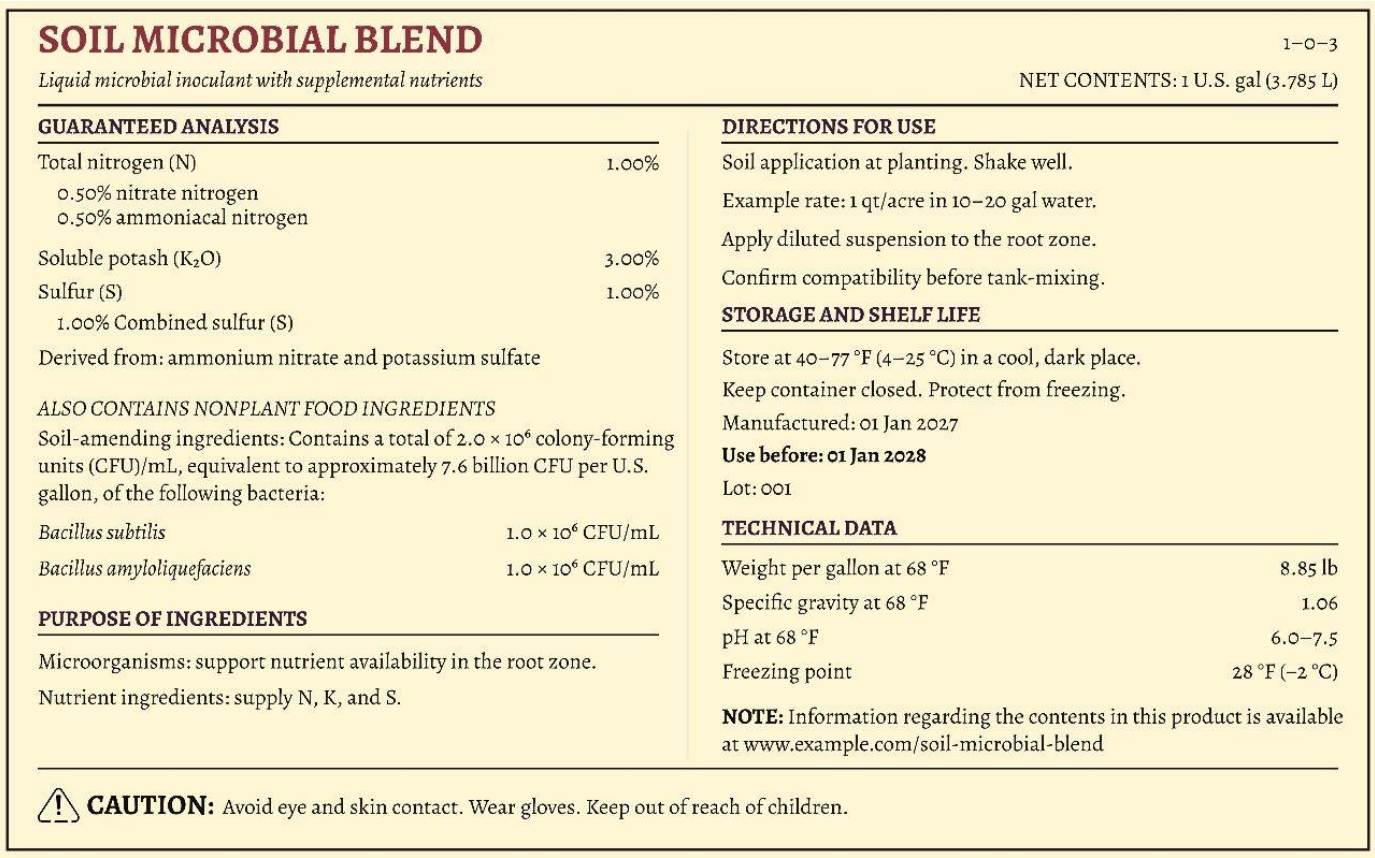
Purpose of ingredients: Explains the intended benefit, such as "support nutrient availability in the root zone." This helps growers understand why microbes and nutrients are included.

Storage and shelf life: The label directs users to store at 40°F to 77°F (4°C–25°C) in a cool, dark place and notes an expiration period (12 months). Because microbes are living, these instructions are critical to keep them viable. Florida's high temperatures can reduce effectiveness well before the expiration date if storage conditions exceed recommended ranges.

Technical data: Provides handling details such as net content, weight per gallon, pH range (6.0–7.5), and freezing point. These factors matter for compatibility with irrigation or tank mixes.

Cautions and safety information: Most labels include a hazard icon and safety warnings, such as "Avoid eye and skin contact. Wear gloves. Keep out of reach of children." Always follow these warnings to protect handlers.

Additional notes: Labels may direct users to additional product information online, as illustrated in Figure 3.



SOIL MICROBIAL BLEND 1–0–3

Liquid microbial inoculant with supplemental nutrients NET CONTENTS: 1 U.S. gal (3.785 L)

GUARANTEED ANALYSIS

Total nitrogen (N)	1.00%
0.50% nitrate nitrogen	
0.50% ammoniacal nitrogen	
Soluble potash (K_2O)	3.00%
Sulfur (S)	1.00%
1.00% Combined sulfur (S)	

Derived from: ammonium nitrate and potassium sulfate

ALSO CONTAINS NONPLANT FOOD INGREDIENTS

Soil-amending ingredients: Contains a total of 2.0×10^6 colony-forming units (CFU)/mL, equivalent to approximately 7.6 billion CFU per U.S. gallon, of the following bacteria:

Bacillus subtilis	1.0×10^6 CFU/mL
Bacillus amyloliquefaciens	1.0×10^6 CFU/mL

PURPOSE OF INGREDIENTS

Microorganisms: support nutrient availability in the root zone.

Nutrient ingredients: supply N, K, and S.

DIRECTIONS FOR USE

Soil application at planting. Shake well.

Example rate: 1 qt/acre in 10–20 gal water.

Apply diluted suspension to the root zone.

Confirm compatibility before tank-mixing.

STORAGE AND SHELF LIFE

Store at 40–77 °F (4–25 °C) in a cool, dark place.

Keep container closed. Protect from freezing.

Manufactured: 01 Jan 2027

Use before: 01 Jan 2028

Lot: 001

TECHNICAL DATA

Weight per gallon at 68 °F	8.85 lb
Specific gravity at 68 °F	1.06
pH at 68 °F	6.0–7.5
Freezing point	28 °F (−2 °C)

NOTE: Information regarding the contents in this product is available at www.example.com/soil-microbial-blend

⚠ **CAUTION:** Avoid eye and skin contact. Wear gloves. Keep out of reach of children.

Figure 3. Example of a biofertilizer label showing guaranteed analysis, microbial content, application directions, storage, and safety information. Credit: Md Shakil Uddin, UF/IFAS.

Challenges and Opportunities in Florida Agriculture

Biofertilizers can provide real benefits, but crop type, soil conditions, and weather influence performance. In Florida, these factors include sandy Entisols with low organic matter, rapid drainage, and seasonal water table fluctuations that affect microbial survival and nutrient cycling. Most products are strain-specific rather than universal, and because they supply little N-P-K, high-demand crops still require a balanced fertility program. Therefore, biofertilizers should be viewed as complements to rather than replacements for conventional fertilizer programs. Compatibility also matters because high-salt fertilizers, certain pesticides, extreme pH, and long tank mixes can reduce live microbe counts. Product variability is also an important aspect to consider. Viable cell counts, formulation (i.e., liquid or dry), and shelf life can differ substantially among various manufacturers' products, and some products lose microbial viability quickly if storage recommendations are not followed. Product quality and persistence may vary, and availability can be limited in rural markets. However, Florida has one of the highest numbers of registered biofertilizers in the country, with about 154 products listed (Santos et al. 2024), suggesting growers statewide may have many options even if local access may vary. Using products that are specifically registered and approved for use in Florida helps ensure labeling accuracy, appropriate strain identification, and quality control.

Florida also presents unique opportunities for biofertilizer use. The state's organic "muck" soils (Histosols) in the Everglades Agricultural Area contain substantial amounts of legacy nutrients, and microbial products that release tied-up nutrients can help reduce added fertilizer needs. Florida's subtropical climate supports year-round fruit and vegetable production, creating multiple windows to integrate biofertilizers across crop cycles. Extension trials and on-farm testing will be key to evaluating performance and identifying the products that work best under Florida's cropping systems.

Take-Home Messages for Growers

- Biofertilizers can support nutrient use efficiency, but they are not stand-alone solutions. They should be integrated with a balanced fertility program.
- Start with small-scale trials on part of the farm, evaluate crop performance and return on investment, and consult Extension before expanding to whole-farm adoption.
- Growers should review product literature related to product efficacy, storage, mixing, suitable crops, application methods, and local conditions before using the products.
- Select products that match Florida's crop and soil conditions. Choosing the correct microbial species and formulation is essential for Florida soils, especially sandy soils with low organic matter.
- Successful use depends on product, crop, and soil fit along with proper handling, storage, compatibility, and timing.

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Table 1. Major categories of biofertilizers with their functions and examples of corresponding commercial products available in Florida.

Biofertilizer Type	Key Microbial Species	How They Work	Example Products
Nitrogen-fixing inoculants	*Bradyrhizobium japonicum*, *Rhizobium leguminosarum*, *Azospirillum brasilense*	Convert atmospheric nitrogen into forms plants can use.	Vault SP, N-Take, Encompass, Accolade-L, AZOSPIN, Acetogen, Envita, HiStick®
Phosphorus-solubilizing inoculants	*Bacillus megaterium*, *Penicillium bilaiae*, *Bacillus amyloliquefaciens*	Release bound phosphorus from soil reserves.	MegaPhos SP, SolubPhos, NutrioUnlock, Utrisha P, XiteBio Yield+, PHOSFERT+
Potassium-solubilizing inoculants	*Bacillus mucilaginosus*, *B. edaphicus*, *B. circulans*, *Paenibacillus* spp., *Acidithiobacillus ferrooxidans*, *Pseudomonas*, *Burkholderia*, *Aspergillus* spp.	Release potassium ions into soil solution for plant uptake.	PrimAgro K, Potak, Symbion-K, KMB, KRISA
Mycorrhizal fungi	*Glomus* spp., *Rhizophagus irregularis*	Form partnerships with roots to expand nutrient and water access.	MycoApply EndoMaxx, LALRISE MAX WP, Mykos Gold, RhizoGold, Mycozoots
Plant growth-promoting bacteria	*Bacillus subtilis*, *Pseudomonas fluorescens*, *Trichoderma harzianum*	Produce growth hormones; improve nutrient cycling; protect against diseases.	Armory, Rhizolizer Duo, Guardian

Table 2. Compatibility, storage, and mixing considerations for common biofertilizer application methods in Florida cropping systems.

Method	Compatible with Other Inputs	Storage Rules	"Do Not Mix"
Seed treatment	If label-approved	Cool, dry, short-term only	Fungicides, unapproved chemicals
Furrow application	With compost, water	N/A (applied immediately)	Incompatible soil amendments
Seedling root dipping	Clean water only	Use immediately after dip	Contaminated water, pesticides
Foliar spray	If tank-mix compatible	Use fresh; avoid midday heat	Incompatible tank mixes, hard water
Fertigation	If system-compatible	Use fresh; filter required	Salts, acids, unfiltered solutions

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All chemicals should be used in accordance with directions on the manufacturer's label.

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