



Technical Bulletin

AscendTM PA



*Production Agricultural
VA-Mycohrizal Soil and Root Inoculant*

Mycorrhizal fungi are as old as plant life itself. It wasn't until the late 1800's that a symbiotic relationship was first discovered between certain species of fungi and plant roots. Horticulturists have touted the benefits of mycorrhizal fungi for decades, but no one had the technology to make it commercially available for growers.

AscendTM PA (Production Agriculture) from BioScientific, Inc. is a liquid biological fertilizer that increases a plant's ability to utilize available nutrients and moisture in the soil. As-

scend PA contains naturally occurring endomycorrhizal fungal spores that germinate and penetrate a plant's roots. The mycorrhizal fungi send out additional hyphae that act as a "**secondary root system**". These microscopic hyphae search out additional moisture and nutrients that a plant cannot find with its normal root system. This symbiotic relationship increases plant growth to create a plant that is more resistant to stress.

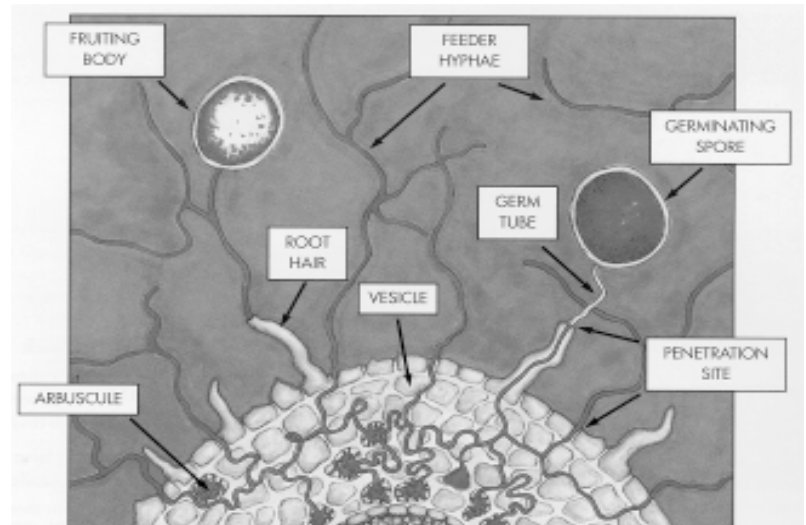


Illustration of the Ascend PA fungi activity on a root.

Mycorrhizal fungi occur naturally in many soils, but their presence is often lacking where they are needed most. This includes sterile growing media, fumigated or pasteurized soil, cut and fill leveling, and flooded or fallow areas. The use of Ascend PA puts mycorrhizal fungi into areas where it is absent or has been destroyed. This increases the inoculated plant's ability to survive and prosper in these induced stress conditions.

Owners and operators of farms, ornamental nurseries, golf courses, agricultural production nurseries, land and tree care operations, municipal parks, and greenhouse operations are already discovering the economic and production advantages of using Ascend PA. Increasing a plant's ability to absorb more nutrients can lead to many advantages for your operation.

Increased Plant Growth and Appearance

Plants inoculated with AscendTM PA will be more vigorous compared to plants that are lacking mycorrhizal fungi. This allows the plants to achieve more growth in a shorter period of time. The plant's appearance will be enhanced, since it is less likely to suffer from nutrient deficiencies and environmental stresses.

Better Developed Root System

The root mass of the plant will increase in size and longevity. The additional hyphae from the mycorrhizal fungi can increase the root surface area by 10 to 1000 times. This gives your plants up to 1000 more opportunities to find additional water and nutrients in the soil.

Reduced Effects of Transplant Shock

Due to the additional root surface area, inoculated plants are more likely to survive the stress of transplanting. This increases "out-plant" survivability in the field and reduces losses in the greenhouse.

Reduced Effects of Stress

High soil pH and salt content conditions can tie up valuable nutrients and water, making them unavailable to the plant. The added root surface area that can be obtained from the use of Ascend PA allows the plant to find more nutrients and moisture in these difficult conditions. Inoculated plants will also be more adaptive to surviving conditions of drought and compaction and better able to resist invading plant pathogens.

Sustainable/Organic Product

Ascend PA contains naturally occurring fungi that can be used safely in environmentally sensitive areas. The Mycorrhizal fungi in Ascend PA are naturally occurring ubiquitous organisms, for use as a re-inoculant for soils, in which they are lacking. Ascend PA is certified for organic growing practices by Organic Materials Review Institute (OMRI).

Rates and Methods of Application

The labeled rate for Ascend™ PA are 3-30 gallons per acre. Placement accuracy will determine the specific rate. A greater placement accuracy into the root zone will allow a lower rate of application.

Ascend PA can be applied through an irrigation system, as a soil drench, banded, shank injected, or as a root dip. Since mycorrhizal fungi are UV light sensitive, it is important to keep inoculum off the soil surface to avoid degradation. When applying Ascend PA by the drench method, apply sufficient water to carry the spores away from the soil surface and into the soil. Avoid using excess water that could move Ascend PA away from the root zone.

Storage and Handling

Each package of Ascend PA includes a container of nutrient liquid carrier and a Dry Concentrate activator packette. Store the DC packs in a cool place out of direct sunlight. Mix the two packages before applying.

BioScientific, Inc. has taken a leadership position with Ascend PA, the first liquid formulation of mycorrhizal fungi available.

Certified Disease Free

Each container of Ascend PA is certified free of plant and human pathogens. This ensures safety and that you are receiving beneficial fungi and not introducing a pathogen into your operation.

Economical

Ascend PA is the most economical mycorrhizal fungal product on the market. It is often half the cost of other products and is backed by the technical expertise of BioScientific, Inc.

Extended Shelf Life

Mycorrhizal products are living organisms. Most mycorrhizal formulations are viable for only 30 to 90 days. Ascend PA is guaranteed viable for six months. Each container is labeled with an expiration date to ensure its viability.

Application Flexibility

Ascend PA has more application options than other mycorrhizal products. Ascend PA is the only mycorrhizal product that can be applied through an irrigation system, including drip tape and emitters.

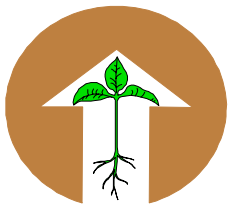
High Concentration of Spores

Ascend PA is specifically formulated for Agricultural operations. The high concentration of spores will ensure colonization of your plants when used according to the label.

ISO 9002

Ascend PA is manufactured according to ISO 9002 standards, and is a tangible expression of a commitment to quality that is internationally understood and accepted.

Ascend™ PA is widely distributed in South, Central and North America. Contact your local fertilizer or chemical supplier to learn how you can include Ascend PA in your operation.



Statement of Composition:

Glomus intrardices.....1.0 propagule/cc
"NONPLANT FOOD INGREDIENT"

Net Weight: 8.39 lb./gal (0.99 kg/l)

Expiration Date: This product will expire on _____, or six months from the date of shipment.

DIRECTIONS FOR USE

General Information: Ascend™ PA is a Vesicular-Arbuscular Mycorrhizal (VAM) soil and root inoculant designed for use under VAM deficient soil conditions such as those soils that have been sterilized by prolonged flooded, or fallowing, or those soils that have been solarized, fumigated, pasteurizes. Likewise this product is of benefit to artificial media, light textured and low organic matter soils. Ascend™ PA can also be used following applications of soil pesticides that reduce naturally occurring VAM populations. Ascend™ PA is labeled for use on all commercially grown Production Agricultural (PA) commodities; excluding ecto, ecto-endo, and ericodal mycorrhizal plant families. Ascend™ PA can be applied prior to planting, at planting or during the growing season. Do not apply Ascend™ PA prior to soil sterilization. To achieve best results, this product should be used in an integrated management program and early in the plant's development.

Mixing Instructions: Ascend™ is not ready for use until Ascend™ PA and Ascend™ Dry Concentrate (DC) are mixed. Your packet of Ascend™ DC is included with this container and has further mixing instructions. Mixing should take place just prior to application, and at the quantity to be used. Combine ingredients at the concentration's specified by the Ascend™ DC label and shake, stir or agitate for five minutes before use. Ascend™ PA is ready for use after mixing and when the liquid has turned **green** in color. *Do not use Ascend™ PA if liquid is not green in color.*

Compatibilities: Ascend™ PA is compatible with a wide range of fertilizers. To assure the compatibility of Ascend™ PA with new combinations of fertilizer and other soil conditioners, pour an amount of the contents into a small container in the correct proportions. After a thorough mixing, let stand for 5 minutes. If the combination remains mixed, or can be readily remixed, the mixture is compatible. Tankmixing with fertilizers should only take place at the time of application. Do not store the combination. The following is a short list of incompatibilities: Maintain a pH range of 6-8 by avoiding strongly acidic/basic conditions and biocides such as free ammonia, chlorine and some pesticides. Do not mix with Aqueous Ammonia, Sulfuric Acid, Urea Sulfuric Acid, Phosphoric Acid, Soil Fumigants or Soil Fungicides. When using Ascend™ PA after pesticide and fumigant treatments make applications after the toxicant has dissipated (Refer to pesticide label for guidelines). There are, at the time of this printing, no other known incompatibilities.

Handling: Follow appropriate general safety procedures. In case of accidental exposure, flush with plenty of water. Refer to Material Safety Data Sheet (MSDS) for additional information.

SHAKE, STIR OR AGITATE BEFORE USE. When handled in bulk quantities, storage in a cone bottomed tank is recommended to facilitate agitation. When stored in a cone bottomed tank, agitate 10 minutes prior to use. When stored in a flat-bottomed tank, agitate one hour before use. Avoid air blast agitation as foaming may result. If foaming does occur through normal agitation, use an approved food grade defoamer. Agitation is recommended once every month. Storage past the expiration date is not recommended.

APPLYING ASCEND™ PA

Ascend™ PA is a Vesicular-Arbuscular Mycorrhizal soil and root inoculant, apply Ascend™ PA to deficient soils in close proximity to the seed and newly developed root system. Ascend™ PA can be applied via seedline shank injection, drip chemigation, subsoil drip line chemigation, drenching, mixing in the transplant water, or using a soil covering method.

General application guidelines: Use 15-30 gallons per broadcast acre equivalent early in the growing season, or as needed. See the placement specific guidelines below (Table 1) for further placement efficiency guidelines. As this product is only of benefit to plant roots: *Applications of high placement accuracy will allow lower rates, while low placement accuracy will necessitate a higher rate (see General Rates For Application).*

Soil Moisture: Application should be made under "good seedbed conditions". This includes thorough cultivation of the soil and pre-irrigation to 50 to 75% soil moisture conditions. Soil moisture can be estimated by squeezing a handful of soil into a ball. If the ball holds its shape and then easily breaks up, moisture is generally within this range.

Environmental factors: Ascend™ PA is sensitive to ultraviolet light. Ascend™ PA should be applied using a subterranean technique or in sufficient water to move the product off the soil surface and into the plant root zone. To get the optimum results from Ascend™ PA, apply when the soil is between 50 and 100 degrees Fahrenheit.

Note: The use of Ascend™ PA may affect crop nutrient response through increased root surface area. Utilize soil and tissue testing to determine nutrient needs. Caution should be exercised when applying Ascend™ PA with high salt fertilizers to prevent "fertilizer salt" induced phytotoxicity. Where fertilizer salts are the combination of Nitrogen, Potassium and metal salts, do not exceed 5 lb. of total salt on the seed and/or 10 lb. of salt per inch away from the seed. Where warranted, adjust fertilizer rate and replace with a maximum of a 1:1 ratio of up to 30 gallons of Ascend™ PA/acre/application.

General Rates For Application:

Broadcast rates for Ascend™ PA can be reduced in field grown crops in the following ways: Shank injection, banded, in furrow sprays, soil covering methods, layby, drench, in the transplant water, or by drip chemigation. Means to calculate rates will be elaborated on below. However, the following table gives one an idea of what rates are usually applied per total acre equivalent:

Table 1.		
Treatment Method	Field/Row Crops Gallons per acre	Tree/Vine Crops Gallons per acre
Broadcast	30	30
Sidedress	8-10	10-15
Micro-irrigation	5-8	5-8
Transplant	3-5	3-8
On seed	3-5	-
Under seed	3-8	-

Banding: For banded (shank injection, band drench or seedline dribble) applications the treatment area actually is the area covered by the band, not the total cropland planted. Some application recommendations are based on treating in-the-row and these rates are generally specified as liquid amounts of product per

certain row length. Others express rates as amount per treated acre, which means the total area treated with the product. If rates are expressed as amount per treated acre and banded applications are used, the amount of product used will be proportionately less. The following formula can be used to calculate the amount of Ascend™ PA needed per acre of crop when banded applications are made:

$$\frac{\text{Band width in inches}}{\text{Row spacing in inches}} \times \text{Broadcast rate/Acre} = \text{Total amount needed per acre.}$$

Drenching Method: Apply Ascend™ PA in sufficient water or fertilizer to move Ascend™ PA off the soil surface and into the root zone, but not beyond. See band application calculations for instructions on calculating the amount of product to apply.

Soil Coverage Method: At planting time apply 15 gallons of Ascend™ PA per acre. Please reference the banding application notes listed above concerning band application calculations. Apply the specified dosage to the soil around the seed and to the covering soil as it fills in the furrow. The product should be below the seed as much as possible, with the exception of potatoes where it should generally be above the seed piece.

MICRO SPRINKLER OR DRIP IRRIGATION SYSTEMS

Chemigation Application Guidelines: Apply 15-30 gallons of Ascend™ PA per acre depending on the crop, depth of application, and water holding capacity of the soil. For proper application:

1. Determine the area (length x width) to be treated, divide by the number of acres and multiply by the rate per the number of acres to be treated. This number is the total gallons of Ascend™ PA needed to treat the field or irrigation block.

2. Ascend™ PA can be safely metered into drip systems. Determine the amount of water needed to saturate the root zone (0.5" to 1.25" of water), divide this by the time needed to apply the necessary water. This number is the time required to make the application of Ascend™ PA.

3. Divide the number of gallons from Step 1 by the treatments time in Step 2. This number is the application rate of Ascend™ PA per unit of time. Apply Ascend™ PA at this treatment rate until desired application rate has been reached.

Drip Chemigation Calibration Instructions: During pre-irrigation check drip tape for uniform distribution (See calibration information below) and repair if necessary. Once the system is calibrated add the amount of Ascend™ PA required for treatments as calculated above, or generally 3-8 gallons per total treated acre, to the middle third of the irrigation set. Follow these guidelines:

Step-by-Step Instructions

- Each run of the irrigation system must be calibrated separately to determine the time it takes water to move through the system and to make sure all emitters are putting out the same amount of water.
- Before starting to calibrate, operate the system until all emitters are putting out equal flow rates or until the system is operating at full pressure.
- Only pressure injection or venturi equipment is recommended.
- Determine the area to be treated in each irrigation run.
- For calibration, substitute a concentrated detergent or a soluble fertilizer in the injection tank. The detergent will bubble as it leaves the emitters. The time period over which bubbles occur should be checked for both the closest and farthest emitters. If a soluble fertilizer is used, measure the time intervals with a salt bridge.
- If the period of detection of the indicator solution between the emitters are within two minutes of each other, comparable coverage will be obtained. If they are not, make adjustments to dilution ratio, using more or less water per part Ascend™ PA or adjust the injector to a slower or faster rate.
- Once the system is calibrated, dilute the needed amount of Ascend™ PA with water using a minimum of 5 parts water/fertilizer solution to 1 part Ascend™ PA.
- Do not begin to inject Ascend™ PA into the system until all emitters are producing equal flow rates, or until the system is at full pressure.
- Inject Ascend™ PA into the system in the middle of the irrigation set of a 1/2 - 1 inch of irrigation water. With at least 1/4" of additional water to move product off of the surface.

CROPS THAT CAN BE TREATED WITH ASCEND™ PA:

Below is a partial list of the agricultural plants that can be treated with Ascend PA. For a listing of nursery, turf and ornamental plants refer to the Ascend NTC label:

Alfalfa	Carrot	Currant	Mango	Pecan	Strawberry
Almonds	Cassava	Date Palm	Maple, All	Pepper, All	Stone fruit, All
Apples	Cedar	Eggplant	Melon, All	Pigeon Peas	Sudan Grass
Apricot	Celery	Fescue	Millet	Pineapple	Sugar Cane
Artichoke	Cereal Grains, All	Fig	Oil Palm	Pistachio	Sugar Maple
Asparagus	Cherry	Garlic	Okra	Plum	Sunflower
Avocado	Chick pea	Grapes, All	Olive	Poplar	Sweet Potato
Banana	Chili, All	Grapefruit	Onions	Potato	Tea
Barley	Citrus, All	Grass family	Orange	Prunes	Tobacco
Basil	Clover	Honey dew	Passion Fruit	Raspberry	Tomato
Bayberry	Coconut Palm	Jjoba	Papaya	Redwood	Walnut
Beans, All	Coffee	Kiwi	Peach	Rice	Watermelon
Blackberry	Corn	Lemon	Peanut	Russian Olive	Wheat
Brazil. RubberTree	Cotton	Lettuce	Pear	Rye	Yam
Bulbs, All	Cowpeas	Lentil	Peas, All	Soybeans	
Cactus	Cucumber	Leek		Squash, All	
Cantaloupe					

Do not use Ascend™ PA on these plant families:

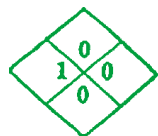
Some plant families do not become colonized successfully by the endomycorrhizal fungus even in the most favorable growing conditions. The following lists are plant families, and examples for each:

- Betulaceae (Birch)
- Caryophyllaceae (Carnation)
- Cruciferae (Broccoli, Cauliflower, Turnip and Mustard)
- Ericaceae (Blueberry, Cranberry, Heath, Rhododendron and Azalea)
- Juncaceae (Rush)
- Orchidaceae (Cattleya, Orchid and Phalaenopsis)
- Proteaceae (Protea)
- Brassica (Cabbage)
- Chenopodiaceae (Beet and Spinach)
- Cyperaceae (Sedge)
- Fagaceae (Beech, Oak)
- Myrtaceae (Eucalyptus)
- Pinaceae (Pine, Fir and Spruce)
- Salicaceae (Willow)

STORAGE AND DISPOSAL:

Storage: Store Dry Concentrate packets in a cool dry place out of the sun. Although not necessary, storage between 40 to 70 degrees Fahrenheit will extend the products potency. Ascend™ PA should not be allowed to freeze. Keep containers tightly closed when not in use.

Container Disposal: Triple rinse (or equivalent), then puncture and dispose of in accordance with all local, state and federal guidelines.



Manufactured by:
Bio Scientific, Inc.

4405 S. Litchfield Rd., Avondale, AZ 85323
1-800-USA-BIO1



Net Contents _____ gal (_____l)

Lot No. _____

Revision Date: 8/3/97

Version 6

1 "Ascend is the trademark of BioScientific, Inc.

2 "With Mycorise inside"

Seller warrants that this product conforms to its chemical description and is reasonably fit for the purpose referred to in the directions for use when used in accordance with the directions under normal conditions. Buyer assumes the risk of any use contrary to such directions. Seller makes no other warranty of representation of any kind, expressed or implied, concerning the product, including NO IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS OF THE GOODS FOR ANY OTHER PARTICULAR PURPOSE. No such warranties shall be implied by law and no agent of the seller is authorized to alter this warranty in any way except in writing with a specific reference to this warranty. The exclusive remedy against seller shall be a claim for damages not to exceed the purchase price of the product, without regard to whether such a claim is based upon breach of warranty or tort. Any controversy of claim arising out of, or relating to this contract, or breach thereof, shall be settled by arbitration in accordance with the commercial arbitration rules of the American Arbitration Association, and judgement upon the award rendered by the Arbitrator(s) may be entered in any court having jurisdiction thereof.



AscendTM PA

VA-Mycorrhizal Soil and Root Inoculant, for use on Production Agricultural Crops

“For growers with deficient soil ecologies, BioScientific’s *Ascend PA* is a liquid culture of VA mycorrhizal fungi that promotes growth over fertilizers alone. Unlike fertilizers alone the use of *Ascend PA* establishes the most elemental component of soil/plant fertility, while providing for a foundation of disease resistance.”

BACKGROUND

Biotechnology can be defined as the controlled use of living organisms or their components for the benefit of mankind. One aspect of biotechnology involves the special relationships formed between certain fungi and plants, called mycorrhizae, which have been shown to dramatically enhance the establishment, growth, development and survival of plants. The term mycorrhiza; means “fungus root” and can be defined as a beneficial symbiotic association between plant roots and specific soil fungi. In the mycorrhizal relationship, the fungus penetrates roots to form a new organ called the mycorrhizae.

The most agronomically important mycorrhizal fungi found in North America are those in the endogonacea family, also referred to as VA Mycorrhizae (VAM). As a “biological fertilizer,” *Ascend PA* contains viable spores and infective propagules from the VAM: *Glomus intraradices*. Although, there is host specificity between different species, the fungi in the inoculant *Ascend PA*, will colonize plant roots in the absence of the preferred symbiont. This is particularly valuable in a sterile soil media, and/or where a earlier or rapid colonization benefit is desired.

FREQUENTLY ASKED QUESTIONS:

How does *Ascend PA* help plants?

Once colonized, the ecto-cellular fungal hyphae extend the surface area of the host root system allowing for the increased uptake of the critical nutrients: Phosphorus, Nitrogen, Zinc, Copper, etc., and Water. While increasing tolerance to drought, salts and pesticides. Also this “fungal net” creates a physical and biochemical barrier to root pathogens.

Ascend PA benefits plants by increasing:

- ▣ Nutrient and water uptake.
- ▣ Root health and disease resistance.
- ▣ Tolerance to environmental stresses.

Which soils most need *Ascend PA*?

Sterile soil ecologies, whether induced by cultural practices (e.g. fumigation, fallowing) or by nature, lack the benefits of mycorrhizae. Also, soils with “immobilized phosphorus” can benefit. Mycorrhizae are of most benefit in poor soils.

Aren’t mycorrhizae already in the soil?

All natural soils contain some level of mycorrhizae, but they are easily destroyed. Many practices can degrade mycorrhizae, such as: Long Fallowing, frequent disking, “cut and fill” land leveling, pesticides, and acid or ammonia fertilizers. Once lacking re-introduction becomes prudent.

How does one know they have a deficient soil ecology?

Sub-optimum productivity, slow, uneven growth or Phosphate/Zinc deficiencies are the most common, however in some cases the crop will stop growth after the cotyledon stage, which is common to fumigated and cool/wet soils.

How can mycorrhizae be introduced into the soil?

Cultural systems that use minimum tillage, and “pro-biotic” inputs can encourage the development of natural mycorrhizae. However, accurately timed/placed applications of *Ascend PA* will ensure that the plant has the greatest opportunity for optimum development.

What crops need *Ascend PA*?

About 92% of all plant families, but dependent crops include: Asparagus, Beets, Cereal Crops, Chilies, Citrus, Carrots,

Cotton, Corn, Deciduous fruit and nuts, Garlic, Grapes, Legumes, Lettuce, Melons, Onions, Peppers, Potato, Sorghum, Strawberry, Sudan Grass, Squash, Turf grass, Tomato, etc.,

What crops will not benefit from *Ascend PA*?

Although a short list, the following crops do not respond to VAM: The cole crops Broccoli, Cabbage and Cauliflower, and some chenopods such as Spinach and Sugar Beets.

Does *Ascend PA* require special handling?

The viable microorganisms in *Ascend PA* are living and as such require special treatment. As with all living organisms there is a limited life span during which the product must be used.

RATES AND TIMINGS:

RATES:

Label rates are between 5 - 15 gallons per acre per growing season. High placement accuracy will allow lower rates while low placement accuracy will necessitate higher rates. (e.g. 5 g.p.a. in a planter band, or 15 g.p.a. in a pre irrigation)

TIMINGS:

As *Ascend PA* is only of benefit to plant roots; placement accuracy will increase the effectiveness of any application. Place *Ascend PA* in close proximity to newly developing roots.

**Growth enhancements by
Ascend PA fungi:**

<u>Plant</u>	<u>% increase in growth</u>
Alfalfa	301
Apples	90
Avocado	254
Barley	290
Bell pepper	188
Cotton	300
Cowpea	50
Navelorange	2600
Onion	600
Sour orange	1089
Soybean	167
Strawberry	1000
Tomato	144

“The rule rather than the exception...”

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