Introduction

IXPER® products offered by Solvay Chemicals, Inc. include IXPER® 60C and 75C Calcium Peroxide and IXPER® 35M Magnesium Peroxide. These are inorganic peroxides with very slight solubility in water. In the presence of water at their natural pHs, these products decompose to release oxygen and heat as follows:

\[
2\text{CaO}_2 + 2\text{H}_2\text{O} \rightarrow 2\text{Ca(OH)}_2 + \text{O}_2 \text{ (g)}
\]

\[
2\text{MgO}_2 + 2\text{H}_2\text{O} \rightarrow 2\text{Mg(OH)}_2 + \text{O}_2 \text{ (g)}
\]

In buffered systems with a pH substantially lower than their natural pHs, IXPER® products start to exhibit a different behavior. As the pH drops, these products become more soluble, and generate progressively higher ratios of hydrogen peroxide (H\(_2\)O\(_2\)) to gaseous oxygen.

\[
\text{CaO}_2 + 2\text{H}^+ \rightarrow \text{Ca}^{2+} \text{ (aq)} + \text{H}_2\text{O}_2
\]

\[
\text{MgO}_2 + 2\text{H}^+ \rightarrow \text{Mg}^{2+} \text{ (aq)} + \text{H}_2\text{O}_2
\]
The H₂O₂ generated from IXPER® products under reduced pHs can further react in a variety of ways:

\[
\text{H}_2\text{O}_2 + \text{OH}^- \rightarrow \text{H}_2\text{O} + \text{HO}_2^- \\
\text{HO}_2^- + \text{substrate} \rightarrow \text{Oxidized Substrate} + \text{HO}^- \text{ (oxidation)} \\
2\text{H}_2\text{O}_2 \rightarrow 2\text{H}_2\text{O} + \text{O}_2 \text{ (decomposition)}
\]

For additional information on the properties of these products, please refer to technical datasheets IXP-04-001, 002, and 003.

**Agriculture**

Low oxygen in the soil can be generated in waterlogged soils due to heavy rainfall or bad irrigation techniques. For example, when rain guns are used on unstable soils, sand, silt or limestone, soils run together creating a seal that is impervious to oxygen and carbon dioxide.

Typically, soils that are low in organic matter are more difficult to aerate naturally. On the other hand, crops growing at high temperatures or under a lot of sunshine have very high oxygen demand at the roots.

Under these conditions, the lack of enough oxygen reduces root growth resulting in stunted growth, poor yields, lack of seed germination, etc.

IXPER® products can be used for soil amendment in agricultural, horticultural and forestry applications. These products slowly decompose in the moist soil, generating oxygen and the corresponding hydroxide. This can have the following advantages:

- Modify the soil's biological activity as follows:
  - Increase total soil microbial population.
  - Enhance enzyme diversity.
  - Speed aerobic and biological activities at high moisture conditions.
  - Support healthy roots by enhancing symbiotic fungi growth.
- Maintain and protect healthy plant roots.
- Improve the hydraulic conductivity of the soil allowing more efficient movement of oxygen and nutrients. This effect is especially useful in heavy soils.
- Give plants the ability to absorb more water and nutrients and use them more efficiently.

The use of IXPER® products as a source of slow release oxygen to the soil can also provide calcium or magnesium to the soil. Some soils are deficient in one of these two components. The selection of the appropriate IXPER® product can also compensate for such deficiency.

These advantages have several applications in agriculture, horticulture and forestation. Please refer to technical datasheet IXP-04-004 for further information about agricultural applications of IXPER® products.
Tree Transplanting

Transplanting seedlings in forestation, or five to seven year-old schools for park and lawn decoration, is far from being 100% successful. Many trees die from “post operational shock.”

The almost complete loss of its radicals, the transfer into an unfriendly, inhospitable environment and the lack of appropriate care in this period of heavy stress are very often fatal to the transplant. The valuable tree withers and dies.

Very often the lack of sufficient oxygen for the weakened root system in a compacted and/or waterlogged soil is the main cause of death. By ensuring that the rootball gets a steady and long lasting supply of oxygen the impact of transplanting is alleviated and the tree becomes well established.

Indeed IXPER® products may assist the tree to acclimatize more quickly by helping strong radical development. This will lead to enhanced growth and may enable the tree to reach mature status earlier.

Field trials with IXPER® Calcium Peroxide granules

The trial

A test was conducted at Iwaki City Fukushima Prefecture in July 1987 for 2 years using oak trees stripped of their leaves for transplanting. The trees were 2.5m high and 0.1m in diameter. No fertilizer was applied during the test period.

The test was done as follows:

- Dig a hole large enough to contain the rootball easily. For this test, the hole was 50cm in diameter and 40cm deep.
- With soil, mix 300 to 1000g of IXPER® Calcium Peroxide granules which contain approximately 53% calcium peroxide.
- Position the tree securely.
- Fill the hole with the IXPER® Calcium Peroxide enriched soil.
- Firm the soil well.
- Water abundantly.

Design of the plot area

The total area was 16m long equally divided into 4 columns. The total area was 4m wide.

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Untreated tree plot | IXPER® C 300g/tree plot | IXPER® C 500g/tree plot | IXPER® C 1000g/tree plot
Results
The results can be observed in the following pictures. It is clear that admixing of IXPER® Calcium Peroxide granules with the soil is beneficial for the re-establishment of trees, even at low concentrations. This is true for low care planting conditions without special regimes of wearing and fertilizer application.

Initial status of trees
Panoramic view after planting

Just after planting

Two months after planting
Four months after planting

Appearance of growth

Untreated

300g / tree plot

500g / tree plot

1000g / tree plot
One year after planting

Appearance of growth

Untreated

300g / tree plot

500g / tree plot

1000g / tree plot
Seventeen months after planting
Panoramic view of test plot

A panoramic view of the test plot

Two years after planting
Panoramic view

Untreated
**IXPER® Products**

**for Tree Transplanting**

Application Data Sheet

Panoramic view – continued

300g / tree plot

500g / tree plot
Two years after planting
Appearance of growth

Untreated

300g / tree plot

500g / tree plot

1000g / tree plot
Two years after planting
General appearance after pulling out

Untreated

300g / tree plot

500g / tree plot

1000g / tree plot
Two years after planting
Appearance of roots

- Untreated
- 300g / tree plot
- 500g / tree plot
- 1000g / tree plot

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