

TRANSFERM[®]

Featuring MGT 1.0 Technology by MASCOMA

PRODUCT SHEET

TRANSFERM is an advanced strain of *Saccharomyces cerevisiae* expressing a glucoamylase enzyme (GA). It is used in the production of fuel ethanol from liquefied grains. Fuel ethanol production facilities using TRANSFERM may substantially reduce the use of separately purchased GA enzyme and/or improve their fermentation performance.

PERFORMANCE:

TRANSFERM performance is illustrated in Figures 1 and 2. Depending on the process conditions, an ethanol production facility may reduce or eliminate the use of separately purchased GA when using TRANSFERM. A production facility may also observe that TRANSFERM in combination with purchased GA gives a benefit with respect to fermentation cycle time or ethanol yield at a fixed time, as shown in Figure 2. The specific results and benefits will depend on the production plant design and operational parameters.

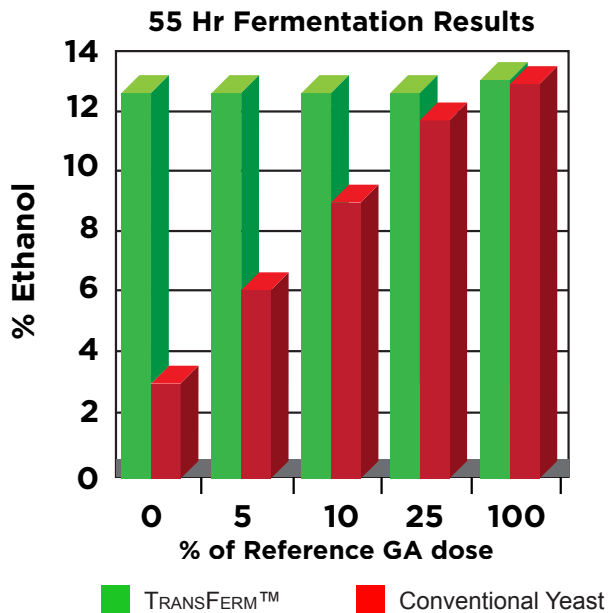


Figure 1: Performance of TRANSFERM in a commercial 32% total solids whole corn mash, compared to conventional yeast, with varying amounts of exogenously added GA. The ethanol titers are at 55 hours fermentation time.

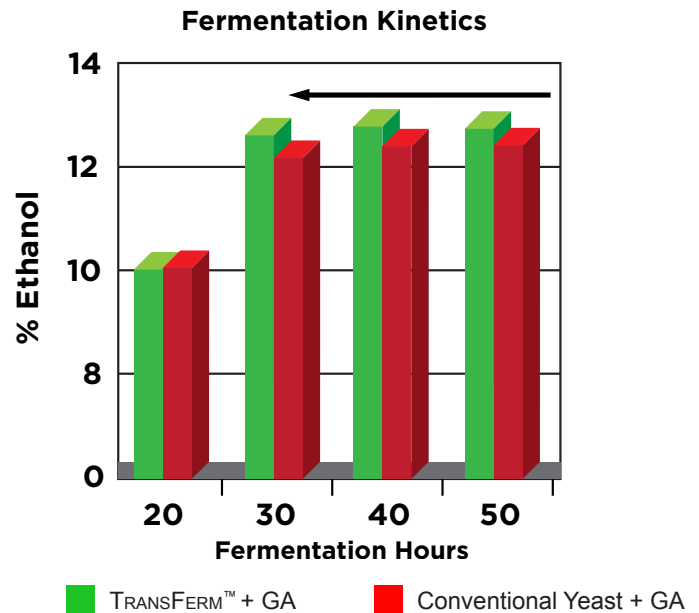


Figure 2: Performance of TRANSFERM in a commercial 32% total solids whole corn mash, compared to conventional yeast, with a standard amount of exogenous GA added to both fermentations.

TRANSFERM®

DIRECTIONS FOR USE:

In a propagation tank with 6-10 hours fermentation time, the recommended dosage is 50-100 kg/batch (0.1-0.20% w/w) into the prop tank. This should be sufficient to provide 200-400 x 10⁶ viable cells/ml at the end of propagation. Please consult your local technical sales representative for more detailed information for your specific plant.

The optimal temperature range for fermentation is 30-35°C (86-95°F). The yeast are able to tolerate short temperature excursions up to 38°C (100°F), though this is to be avoided especially in the later stages of fermentation when ethanol concentration is high. The ideal pH range for fermentation is 4.0 to 5.5.

The yeast should be provided sufficient nitrogen to ensure a robust and complete fermentation. In a whole-corn mash it is preferable to have added nitrogen, supplied for instance as 500-1500 ppm urea or 200-700 ppm of ammonia, or a combination of the two. Use of mash with a lower amino nitrogen content such as fractionated mash may require further added nutrients.

GUIDELINES FOR PRODUCT STORAGE:

TRANSFERM is supplied as a stabilized cream yeast (20% solids) packaged in 1000 kg totes. The product is stable for up to 3 months from date of manufacture when stored at refrigeration temperatures (4°C, 40°F). The product is stable for approximately 1 week when removed from refrigeration and stored at plant temperatures (30°C, 86°F).

QUALITY SPECIFICATIONS:

| PERCENT SOLIDS | VIABLE YEAST CELLS per mL | TOTAL BACTERIAL COUNT per mL | LACTOBACILLUS COUNT per mL |
|----------------|---------------------------|------------------------------|----------------------------|
| 19-22% | > 4 X 10 ⁹ | < 10 ⁴ | < 10 ⁴ |

REGULATORY COMPLIANCE:

U.S. Food and Drug Administration's (FDA) Center for Veterinary Medicine has reviewed the use of the TRANSFERM yeast as a processing aid in the production of animal feed, and issued a letter recommending its inclusion in the Association of American Feed Control Officials (AAFCO) Official Publication. Mascoma Corporation has also determined through scientific procedures that TRANSFERM is GRAS (Generally Recognized as Safe) for the production of Distillers' co-products, such as DDGS, for use in animal feeding applications. This product is only to be used as a processing aid in the production of fuel ethanol and distillers co-products and is not to be used as a direct addition to food or animal feeds.

Facilities using intergeneric microorganisms are subject to certain reporting requirements and review procedures under the Toxic Substances Control Act (TSCA) 40 CFR Part 725. Mascoma's bioengineered *Saccharomyces cerevisiae* strain in TRANSFERM meets the criteria for a Tier 2 Exemption under this statute. For further information, please contact either Lallemand Biofuels & Distilled Spirits or Mascoma.

