Proposal No._____

# The Anderson Research Grant Program 2003-2005

## Project Title:

Development and Optimization of a High-Capacity Continuous-Flow Dryeration Process

**Principal Investigator(s)**

| Name | Institution/Agency/Other |
|---|---|
| Dr. Dirk E. Maier | Agricultural and Biological Engineering |
| | Purdue University |
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(Attach an additional sheet if more space is needed)

**Project Contact:**

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**Period of Proposed Project Dates:**

Beginning: 1. September 2003 Ending: 31. August 2005

**Amount Requested (maximum $20,000 per year for two years):**

Year 1: $20,000 Year 2: $20,000

## *1. – Problem Identification and Related Research*

High-capacity dryers are generally set up on farms and at elevators to rapidly cool dried grain before transferring it to the storage structure. However, employing delayed cooling methods can reduce fuel costs, increase drying capacity, reduce stress cracks, fissuring and brittleness, and provide more operational flexibility. Delayed cooling usually involves transferring hot grain (grain kernel temperature of 100-140ºF, or 38-60ºC) from the high-capacity dryer to separate cooling bins. The most widely used methods are known as dryeration, in-bin cooling, and combination high-and-low temperature drying.

Over the years many researchers have confirmed the benefits of dryeration and in-bin cooling. Ezeike & Otten (1981) showed that tempering corn was the most practical way of retaining grain quality while meeting high throughput demands. They determined that the tempering process worked best in quasi-stationary air. When drying grain, the removal of the last 2-3 points of moisture requires the most energy (Noyes and McKenzie, 1998). With dryeration, this moisture does not need to be removed by the dryer, which increases its capacity significantly. Additionally, capacity can also be increased due to (1) the elimination of the cooling zone in the dryer, (2) the elimination of the cooling cycle after the corn has gone through the batch dryer, and (3) the increase in drying air temperature while keeping the corn below the maximum allowable grain kernel temperature. A recent study by Montross & Maier (2000) confirmed that full-heat drying followed by dryeration or combination drying reduced the total drying cost by approximately 10% compared to continuously drying and cooling within a crossflow dryer. The greatest benefit was an increase of 72% and 159% in drying capacity when dryeration and combination drying were used instead of conventional drying and cooling within the dryer, respectively.