OREGON STATE UNIVERSITY SEED LABORATORY

THE USE OF ERGOVISION INSPECTION STATION IN PURITY TESTING

Adriel Garay, Richard Triplett, Sherry Hanning, Sabry Elias, and Bradford Whiting

The need for advanced technology in Seed Purity Testing

The seed industry requires accurate and timely purity test results to make daily business decisions and maintain their presence in global markets. This means that testing technologies need to be fast and accurate.

The OSU Seed Laboratory, in recent years, experienced backlogs in grass seed purity testing. This is, in part, because of the trend in marketing grass seed that requires testing of large numbers of samples in a narrow window of time. In addition, small seeded grasses are more time consuming to test than large seeds such as soybean or corn. Thus, the OSU Seed Laboratory has researched and developed an improved 'Microscopic Station' that incorporates advanced optical, ergonomic and mechanical technologies to achieve fast and accurate testing. The new equipment is called the '*Ergovision Inspection Station' (Fig. 1)*.

Background

The concept of microscopic purity stations is not new. In the late 60's, the OSU Seed Lab in collaboration with the USDA and Mater International Inc. pioneered the development of the first models. Currently, there are labs using microscopic stations routinely in purity testing, either in its original form or with various modifications. Several models are still maintained and used at the OSU Seed Laboratory.

The Seed Laboratory at the California Department of Food and Agriculture has used stations successfully for over 20 years. In the Washington State Department of Agriculture Seed Lab in Yakima, WA, every purity analyst has a microscopic purity station. Other seed testing labs use such units as well. In general, the result has been positive. Furthermore, the 'Seed Purity' chapter of the newest training manual for seed analysts, published by the Society of Commercial Seed Technologists, recommends it for purity testing.

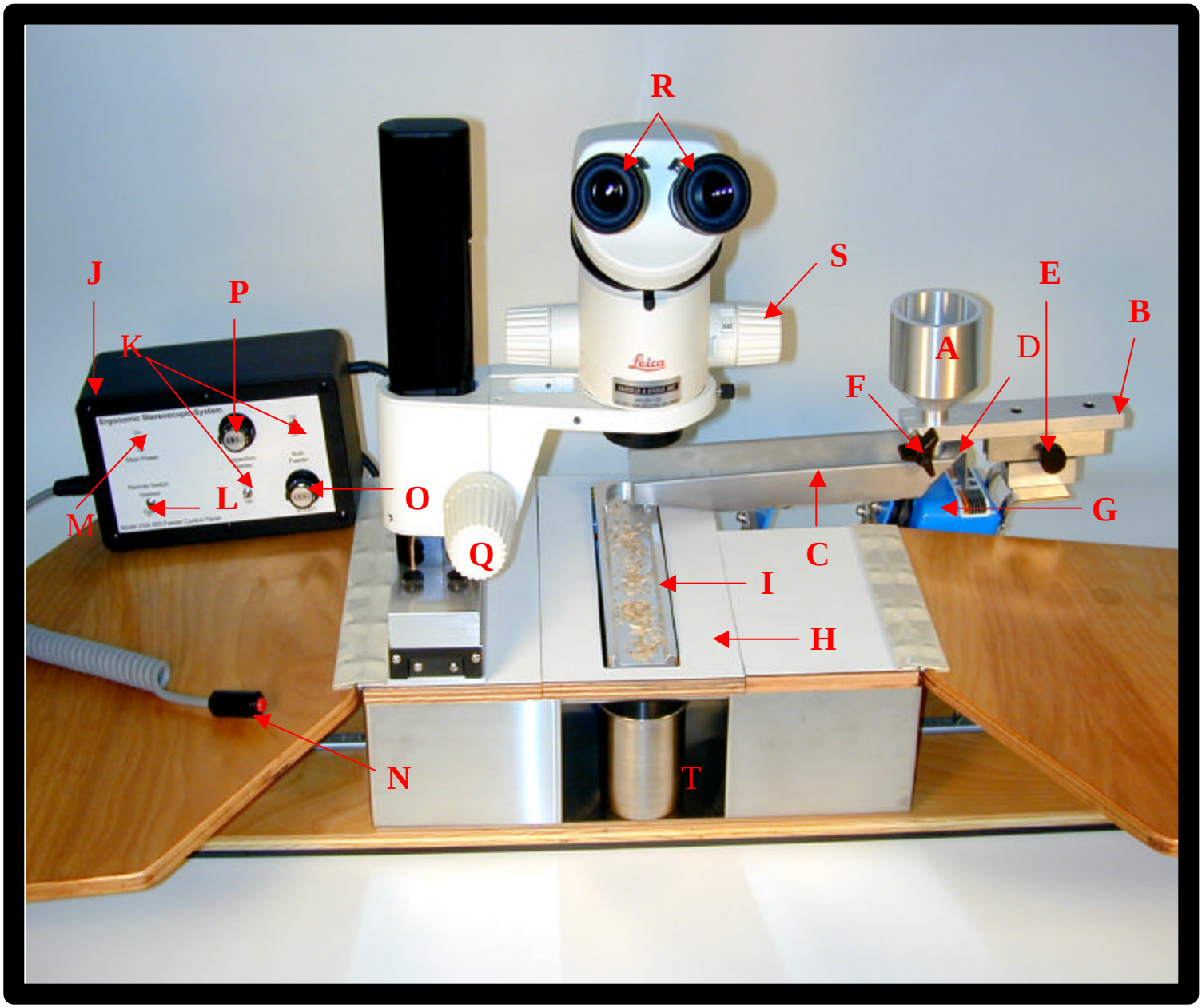

Fig. 1. The Ergovision Inspection Station used by Oregon State University Seed Laboratory is designed to provide optimum ergonomics, magnification, clarity and efficiency.

A. Funnel
B. Funnel holder plate
C. Bulk feeder tray
D. Back plate of bulk feeder tray
E. Funnel adjustment knob
F. Funnel clamp knob
G. Bulk feeder vibrator
H. Removable cover
I. Inspection tray
J. Feeder control panel
K. Feeder switches
L. Remote switch
M. Main power switch
N. Hand switch
O. Bulk speed dial
P. Inspection speed dial
Q. Main focus knob
R. Eye piece focus
S. Magnification setting
T. Collection Cup

The Research, Development, and Validation of the Ergovision Inspection Station

After extensive evaluation of previously existing models of the 'Microscopic Inspection Station', the OSU Seed Laboratory and Mater International decided to redesign and incorporate new technologies. The main goals that were considered in developing the new station were:

1. Accuracy, by providing the best magnification, clarity and resolution for each seed,
2. Ergonomics, to reduce analyst's fatigue and discomfort,
3. Productivity, to ensure fast and timely results.

The main principle in developing any new equipment or method is that the new method should be equal to or superior in accuracy to the existing method. To fulfill this requirement, the following steps were taken by the OSU Seed Laboratory:

- **Initial design**: Input on magnification, lighting, comfort and speed were gathered from analysts. The laboratory is fortunate to have 15 analysts working in the purity testing unit. They provided valuable input in every stage of the process. This input was critical to achieve not just accuracy but also to decrease the fatigue produced by the traditional board-hand lens method.
- **Development of the prototype**: This step ensured that all the critical features identified by analysts were present to full satisfaction. The prototype was evaluated extensively and was modified until optimum performance was achieved.
- **Production of the first units**: Five units were produced prior to the harvest season of 2001. The prototype units focused on small grass seed such as bentgrass and Kentucky bluegrass. These units were assigned to the most experienced analysts in the lab for more evaluation and modification.
- **Production of five additional units:** Prior to the 2002 harvest season, modified inspection trays for tall fescue and ryegrass were designed. This was followed by extensive evaluations to make sure that the station would work at optimum performance for these crops. These units were assigned to experienced analysts as well.
- Prior to the testing season of 2001, each analyst went through an extensive practice period. Comparisons between the traditional and the new method were made. Table 1 presents the comparisons made in time and accuracy.

The stepwise process of research, development, evaluations and gradual adoption of the Ergovision Inspection Station took over two years. Initially, as with any new method, there was a fear that some analysts might not adopt it easily. However, our experience has shown that this fear was unfounded. As expected, some analysts took longer to get used to the new system, but in general, all analysts switched smoothly to the new equipment.

MAIN ATTRIBUTES OF THE ERGOVISION INSPECTION STATION

I. Accuracy

Factors that contribute to the accuracy

As in any analysis, accuracy is the function of analyst proficiency, equipment quality, and operational skills. Therefore, to assure accuracy, the following technologies were integrated to the new system:

- Automated examination tray with precise speed control of the vibration system so that every seed is presented uniformly to the field of vision. The system also has stop-start controls to allow zooming in on specific seeds that need closer examination.
- The use of an advanced optical system that produces a three-dimensional view of the seeds. The optical system is accompanied by high quality illumination provided by fiber optics.
- Clarity and focus can be standardized easily. Magnification and lighting can be set at optimum level for any species. This decreases the possibility of undesirable variations resulting from not seeing the details of each seed clearly.
- The use of both eyes contributes to optimum recognition of the seeds.
- The equipment has simple controls to manage with one hand. This makes it easier to operate so that the analyst can concentrate on identifying seeds.
- Each analyst went through an extensive practice period. They compared the accuracy of both methods (i.e., the traditional purity board and hand lens, and the new equipment) and found that the Ergovision Inspection Station was equivalent or superior to the traditional hand lens method. In some cases, the machine made it easier to find certain contaminants because of the quality optical system (Table 1).
- All tests were monitored routinely through the testing season, as part of the quality assurance system of the laboratory. The Ergovision has proven to be very useful for examination like All States Noxious Exams, Undesirable Grass Seeds Exams, Sod Quality Exams, Crop and Weed Exams, Pest and Diseases and other searches. However, it is less useful for removal of inert matter.

II. Ergonomics

Factors that contribute to ergonomics

The Ergovision Inspection Station is designed to reduce analyst's fatigue and discomfort during seed testing. The following are key factors in the ergonomics of the new station:

- Analysts are able to sit straight at a suitable chair that fits their height, without bending over (as it is the case in the use of hand lens), and they are able to breath comfortably (Fig. 2).
- In the traditional testing of small seeds using the hand-lens method, the analyst normally uses one eye. In the Ergovision method, the analyst uses both eyes at all times (Fig 2). This reduces

the eye strain that resulted from looking at the seed with only one eye when a hand lens is used.

- A tilt-adjustable microscope provides additional ergonomic benefits because the analyst does not have to stretch or bend, which minimizes or eliminates neck and back pain. This feature also provides greater flexibility because analysts with different heights can use the same station.
- The repetitious hand motion to move the seeds to and from the viewing area is eliminated, which reduces hand discomfort.
- The fiber optic light system contributes to viewing clarity, which reduces eye strain.
- The new station is provided with an adjustable arm rest for extra comfort.
- All these factors contribute to the reduction of fatigue and discomfort, which is critical in seed testing, especially during the busy season.

Fig. 2. The Ergovision Inspection Station is designed to reduce analyst's fatigue and discomfort.

Table 1. Accuracy and time comparison of purity analysis results for seed samples of different species tested by traditional purity board and Ergovision Inspection Station.

Sample No.	**Species**	*Type of test*	*Date*	*Time/min*		*Accuracy level of Board and Ergo methods*
				Board	*Ergo*	
1	Tall Fescue	Sod Quality	4-10-01	100	45	Same[1]
2	Ryegrass	Noxious Weed Exam (Nox.)	4-10-01	N/A[3]	32	Same
3	Ryegrass	Nox.	4-10-01	50	34	Same
4	Tall Fescue	Nox.	4-11-01	50	35	Same[2]
5	Ryegrass	Nox.	4-11-01	45	17	Same
6	Ryegrass	Nox.	4-30-01	30	30	Same
7	Tall Fescue	Nox.	4-30-01	60	31	Same
8	Hard Fescue	Nox.	4-30-01	60	29	Same
9	Ryegrass	Nox.	4-30-01	35	30	Same
10	Chew. Fescue	Nox.	4-30-01	55	40	Same
11	Rough bluegrass	Nox.	5-1-01	N/A	50	Same
12	Tall Fescue	Nox.	5-1-01	75	35	Same
13	Ryegrass	Nox.	5-1-01	40	26	Same
14	Ryegrass	Nox.	5-1-01	50	27	Same
15	Ryegrass	Nox.	5-17-01	N/A	50	Same[2]
16	Ryegrass	Nox.	5-18-01	40	35	Same
17	Ryegrass	Nox.	5-18-01	N/A	23	Same
18	Ryegrass	Nox.	5-18-01	N/A	33	Same
19	Ryegrass	Nox.	5-25-01	N/A	45	Same
20	Ryegrass	Nox.	5-30-01	60	25	Same
21	Ryegrass	Nox.	5-31-01	N/A	24	Same
22	Ryegrass	Nox.	5-31-01	60	22	Same
23	Ryegrass	Nox.	5-31-01	40	21	Same
24	Ryegrass	Nox.	6-6-01	60	34	Same
25	Chewing fescue	Nox.	5-24-01	55	41	*1 Poa annua* found by Ergo and not by board method
26	Chewing fescue	Nox.	5-29-01	45	37	Same
27	Chewing fescue	Nox.	5-30-01	45	37	Same

[1] The same contaminants were found by both 'Board' and 'Ergo' methods.
[2] No noxious weed seeds were found neither by 'Board' nor by 'Ergo' methods.
[3] N/A, data is not available

III. Productivity

Factors that contribute to productivity

The use of the Ergovision Inspection Station resulted in increasing testing efficiency (Table 1). The ergonomic working conditions allow analysts to work extended hours of uninterrupted testing, staying alert, and avoiding sick leaves and absences. These factors contribute to the productivity of the analysts and the laboratory. Accuracy also contributes to productivity because a test that is done correctly the first time eliminates the need to re-do the work. In addition, the following factors contribute to higher output in purity testing:

- The mechanical seed feeder and simple controls enables a continuous seed flow.
- The continuous flow eliminates the gap-time of the traditional method. In the traditional method, the seeds are moved by hand, therefore half of the time the seeds are not in the viewing area and cannot be examined. This gap is eliminated in a continuous flow system.
- Light quality and optimum magnification provide optimum clarity at all times. This enables the analyst to see clearly to make faster decisions with high level of certainty.
- The traditional hand-lens method, some times requires taking certain specimens to a microscopic station in order to make close up inspections. This step is eliminated because the Ergovision station has a capacity to focus on any specimen at any time.

CONCLUSIONS

- After two seasons of testing, the OSU Seed Laboratory experience with the Ergovision Inspection Station has been positive.
- Testing accuracy is equal or superior to the traditional purity board and hand lens method.
- The Ergovision Inspection Stations reduced physical stress despite long hours of testing work. An objective indicator of this fact is that the analysts that have Ergovision equipment do not want to go back to the traditional hand-lens method.
- Productivity has increased about 20-30% compared to the traditional method.
- The new stations have demonstrated a potential to be used in any other test that requires examination under a microscope in a continuous flow. One example is the search for specific weed seeds in larger samples (e.g., 50g Kentucky bluegrass, 100g tall fescue, etc). This attribute is of high value for the quality conscious seed industry.

ACKNOWLEDGMENTS

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