Undergrads help unravel mysteries of soils

NEWARK, Del — Basic laboratory research is usually considered the province of graduate students, or scientists with advanced degrees Two undergraduates in the University of Delaware's department of plant science are getting an early taste of the challenges and frustrations involved in doing this kind of work

Right now senior candidates for degrees with distinction Phil Jardine and Mark Loux are busy in a laboratory in the college of agriculture s new research/teaching facility, Worrilow Hall, trying to figure out how crop nutrients like potassium and boron interact with the soil What they discover may some day help farmers fertilize crops more efficiently, thus saving money and increasing yields

Jardine s project concerns the rate at which potassium (K) ions become bonded and released from two typical Delaware soils—one a sandy coastal plain soil common to Sussex county, the other a loamy sand found on many northern Delaware farms

To determine the rate of bonding or adsorption, Jardine passes a potassium solution through a small amount of soil at a measured rate and collects it in test tubes He then analyzes samples of this leachate from each tube for the amount of K present This tells him how much K has been adsorbed by the soil

Once he can detect no further absorption, he reverses the process, using a calcium chloride solution The calcium ions replace the potassium which became bonded to the soil during the earlier procedure, releasing it back into solution

Once again, he measures the leachate to determine the rate of K release It takes him about a day to perform the entire procedure

To save time and achieve greater accuracy, Jardine uses a fraction collector and a peristaltic pump, which automatically controls the flow of solution into the test tubes To find out how much K remains in the leachate after the soil/K reactions take place, he uses a highly sophisticated piece of equipment called an atomic adsorption spectrophotometer—AA for short This directly measures the concentration of K in solution

At one time in his work last fall he placed the fraction collector in an incubator and ran the experiment at three different temperatures—0 degrees C (32 degrees F), 25 degrees C (77 degrees F), and 40 degrees C (104 degrees F)—to find out how these affect soil/K interactions

He found that in a warmer environment, the rate of reaction was much faster This agrees with field observations by university soil chemists and suggests that as the weather warms up in the spring, there's more available K in the ground than there is in late fall when many farmers take their soil samples

All this data on the rate of K adsorption and release at different temperatures makes it possible to determine the thermodynamics or bonding strength of K in a particular soil This, in turn, provides information that enables soil scientists to predict what potassium leaching losses will be from that soil

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SOLVING POTASSIUM PUZZLE - University of Delaware senior Phil Jardine adjusts flow of solution through fraction collector he's using to find out how potassium behaves on Delaware croplands.

LOOKING FOR ANSWERS IN THE LAB - Mark Loux, a senior doing basic research on behavior of boron in the soil, shown here using atomic adsorption spectrophotometer — AA for short — in U. of D.'s new teaching/research facility, Worrilow Hall.