

Tosi, B., Bonora, A., Dall'Olio, G. and A. Bruni. 1991. *Screening for toxic Thiophene compounds from crude drugs of the family Compositae used in Northern Italy*. *Phytother. Res* 5:59-62.

Trostle, R. 1968. *The ethnobotany of Tagetes*. *Economic Botany*. 22:317-325.

Underwood, J. 1971. *Annuals*. Time-Life Books. New York. 176 pages.

Vasudevan, P., S. Kashyap and S. Sharma. 1997. *Tagetes: A multipurpose plant*. *Bioscience Technology* 62:29-35.

Yoo, H. G. 2000. *Allelopathic effects of essential oils of some plant species in Artemisia on selected plants and microbes*. Ph.D. Thesis, Wonkwang Univ., Iksan, Chonbuk. 144. p.



Sticky Droppings: A Problem in Poultry Due to Feed

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'Sticky droppings' refers to the consistency of poultry droppings and are undesirable because they pose potential health risks to the birds, through respiratory stress from ammonia and potential increase of coccidiosis. Cereal grains are widely known to cause sticky droppings in poultry as well as limited nutrient uptake and growth retardation (Francesch and Brufau, 2004). Barley is generally unpopular as poultry feed because it contains high amounts of a non-starch polysaccharide (NSP) known as mixed-linked -glucan.

Mixed-linked-glucan and other NSPs form important components of endosperm cell walls and are ubiquitous among cereal grains and other seed crops. In barley, NSPs comprise 70% of endosperm walls. Poultry is largely unable to digest these NSPs. NSPs bind with water in the intestinal track, thus increasing the viscosity of the fluid within

the digestive system. The resulting glutinous consistency of droppings causes fecal matter to stick to the cloaca of the bird (also called pasting), which in turn causes dirty eggs and skin infections on chickens' feet. Sticky droppings also reduce the water retention in litter on which broilers are raised, resulting in increased disease incidence and reduced meat quality.

There are several enzyme poultry feed supplements available that enable poultry to break down the NSPs in feed (Peterson and Åman, 1989; McNab and Smithard, 1992). In addition, new barley varieties being developed have low mixed-linked-glucan content. However, the majority of current research efforts in barley breeding focus on maximizing -glucan content for human health benefits. Farmers should be aware of the -glucan content of the barley varieties they feed to poultry.

Sticky droppings should not be confused with normal "caecal" excretions which are the dark brown, glutinous contents of their caecal tubes. Healthy chickens will pass caecal excretions twice a day (Ross Tech, 2006) in addition to the regular brown droppings that have a characteristic white cap of uric acid which they pass 12-16 times each day. When chickens pass only sticky droppings, growers should be aware that there is likely a dietary problem.

References

Francesch, M. and J. Brufau. 2004. *Nutritional factors affecting excreta/litter moisture and quality*. *World's Poultry Science Journal*, 60:64-75. doi:10.1079/WPS20035.

McNab, J.M. and R.R. Smithard. 1992. *Barley -Glucan: An Antinutritional Factor in Poultry Feeding*. *Nutrition Research Reviews*, 5: 45-60 Cambridge University Press. doi:10.1079/NRR19920006

Petersson, D. and P. Åman. 1989. *Enzyme supplementation of a poultry diet containing rye and wheat*. *British Journal of Nutrition*, 62:139-149. doi:10.1079/BJN19890014.

Ross Tech. 2006. *Enteric health in broilers*. Retrieved from <http://www.aviagen.com/docs/Enteric%20Health%20Low%20Res.pdf>.



Implementing Mustard Green Manure Crops on the Fort Hall Indian Reservation

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When pesticides drifted onto tribal members during a sacred ceremony in 1998 and nitrates and pesticides were discovered in their well water, members of the Shoshone and Bannock Tribes launched an effort to reduce fertilizer and pesticide use in their agricultural practices on the Fort Hall Indian Reservation.



Project logo, designed by Sara Irwin, a tribal member, to represent the dawning of a bright, new agricultural future on the Reservation.

The reservation and surrounding counties in eastern Idaho comprise one of the largest potato-growing areas in the country. Some Tribal members are active in ranching, while most of the land is leased to neighboring non-tribal members for the production of irrigated row crops.

As a result of a three-year project with the University of Idaho, the Natural Resources Conservation Service (NRCS), and Western Ag Research, the Tribes established a maximum allowable nitrogen fertilizer level that could be used on the Reservation. With the new standard, growers were able to make significant changes using new irrigation equipment and

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by planting potato varieties requiring less nitrogen.



The Shoshone Bannock Tribes' Water Resource Commissioners and NCAP's program coordinator in a field of mustard green manure during an October 2006 field day.

Next, the Tribes invited Three Rivers Resource Conservation & Development Council and the Northwest Coalition for Alternatives to Pesticides (NCAP) to work on a project to reduce pesticide use. The team first explored the option of lengthening the routine two-year rotation to include a season-long green manure, but determined this was not economically feasible for potato growers on the Reservation. Instead, a cooperating grower developed a demonstration field in 2002 and 2003 where a fall mustard green manure crop was used as an alternative to fumigant use.



Fred Brossy describes his soil building practices during a September 2008 organic potato field day at his farm near Shoshone, Idaho.

The demonstration field focused on the management and economics of using a mustard green manure crop as well as sharing that information with other growers on the Reservation. The project relied upon the research and

materials developed by Washington State University Extension educator, Andy McGuire.

Mustard green manure crops are often planted after wheat harvest, in a potato-wheat rotation. Growers plant by drilling, broadcasting with dry fertilizer, or aerial seeding into standing wheat. For fall incorporation, the crop is disked under before the first hard frost. For Brassica crops, chopping is used to break open plant cells, releasing cell contents to produce biologically active glucosinolates. The plant material is then quickly incorporated into the soil.

In two subsequent years, the project offered a free mustard cover crop seed incentive program to help interested farmers implement the practice. NCAP also partnered with the Potato Growers of Idaho and the University of Idaho to help Idaho NRCS offer farm bill funds through EQIP to help farmers try green manure crops for



Organic potato farmer, Kris Taylor, inspects his organic potato crop near Idaho Falls along with Jeff Bragg, product development manager of Potandon Produce (Green Giant).

pest control. Idaho NRCS now offers EQIP funds for the practice (\$50 per acre for up to 160 acres each year for up to three years), resulting in 25 contracts encompassing 3,900 acres planted across southern Idaho in 2006.

As a result of this project, farmers planted 3,575 acres of mustard cover crop on the Reservation in 2006. Seed salesmen estimated a total of 30,000 acres were planted to mustard cover crops in 2006 across southern Idaho.



Micro Plastic Pollution in Puget Sound and Northwest Straits

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For the last several years, the Port Townsend Marine Science Center has been leading research and education programs focusing on marine plastic pollution in the Puget Sound.

Marine plastic pollution poses a growing problem. The United States alone manufactures more than 115 billion pounds of plastic annually (Casey, 2007). Each American sends an estimated 63 pounds of plastic into landfills each year (Algalita, 2008). Less than 4% of manufactured plastic gets recycled (Werthmann, 2007) and 25% of all manufactured plastic goes unaccounted for in the waste stream (Algalita, 2008). Plastic polymers do not biodegrade, but instead breakdown into smaller fragments. These tiny fragments remain synthetic molecules, and accumulate in many ecosystems throughout the world. The immediate benefits of plastic products are many, but the long term impacts of plastic debris can no longer be ignored.

Most plastic enters the marine ecosystem from land, while marine vessels dump about 20%. In the marine environment, plastics end up on the ocean floor, floating in the open ocean, or deposited on beaches. Certain plastics, such as PVC, drop to the bottom and interrupt the feeding and oxygen exchange of bottom-dwelling benthic organisms. Other plastics, such as polyethylene, float. They are carried with the prevailing ocean currents into open water and concentrate in large gyres, ring like systems of ocean currents, or are deposited in the intertidal beach zone. Each one of these plastic

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