

Control of NH₃ volatilization and nitrogen leaching by application of coated urea associated with properties of the coated materials

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Reducing nitrogen loss is most important for the agricultural sustainable development and the protecting water body quality. The main pathway of nitrogen loss from field soils is NH₃ volatilization and nitrogen leaching. The application of controlled release urea was observed to obviously decrease loss of nitrogen in soil via NH₃ volatilization and nitrogen leaching. Understanding the contribution of nitrogen loss via various pathway after fertilization has important significance to develop control loss of nitrogen in field soils. One field trial including three nitrogen sources (PCR-polymer-coated urea, BCU-biochar-coated urea, and urea) at vegetable rotation (snow pea – squash - Sweet corn) for one year was used to investigate the loss of nitrogen via NH₃ volatilization and nitrogen leaching from field soils after application of 300 kg N/ha as 100% basal (PCR), as 50% basal and 50% topdressing (BCU), and 20% basal, and 80% for three topdressing (30%, 30% , and 20%) (urea) ,respectively, in Dianchi catchment, China. Results indicated that application of coated urea could significantly decrease loss of nitrogen in soils. Compared to urea, application of PCR decreased loss of nitrogen by 45.99kg N/ha (57.6% from NH₃ volatilization reduction) at the first season, by 79.45kg N/ha (49.0% from NH₃ volatilization reduction) at the second season, by 45.2kg N/ha, (76.6% from NH₃ volatilization reduction) at the third season; application of BCU decreased loss of nitrogen by 47.31kg N/ha (42.3% from NH₃ volatilization reduction) at the first season, by 88.81kg N/ha (27.0% from NH₃ volatilization reduction) at the second season, by 54.46kg N/ha, (32.9% from NH₃ volatilization reduction) at the third season. It could be concluded that BCU is to reduce nitrogen loss by controlling nitrogen leaching at the rainy season (the first and third season) and the dry season (the second season); however, PCR is to reduce nitrogen loss by controlling NH₃ volatilization at the rainy season (the first and third season), and by controlling nitrogen leaching at the dry season (the second season). The loss of nitrogen in

soils with applied urea was greater at the dry season (172.63kg N/ha) than those at the rainy season (152.48-161.69kg N/ha). On the contrast, the loss of nitrogen in soils with applied coated urea was greater at the rainy season (106.49-116.49kg N/ha for PCR, 105.17-107.23kg N/ha for BCU) than those at the dry season (93.18kg N/ha for PCR, 83.82kg N/ha for BCU). The difference of relative contribution of decreasing NH₃ volatilization and nitrogen leaching among coated urea could be contributed to properties of the coated materials, because biochar has adsorption capacity of NO₃⁻ in soils. The present results suggested that BCU should be recommended to use at the rainy season, and BCU or PCR should be recommended to use at the dry season in order to effectively reduce loss of nitrogen from field soils.