THE STABILITY OF EXPRESS GIBBERELIC ACID IN COMBINATION WITH LIQUID UREA

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Abstract

The use of Urea in conjunction with gibberellic acid (GA) has been identified as desirable for improved pasture production. Dissolving Urea in water increases the solution pH, which may affect the stability and effectiveness of GA response rates.

GA stability in Urea solutions was tested using HPLC at different time periods (0, 1, 3, 4, 5 and 24 hours). The Urea solution used contained 390g per litre Urea (18%N w/v equivalent). The addition of Urea increased the pH of the GA solution from 6.1 to 8.1. For some treatments this solution was buffered to pH 4.5 (acid) with a commercial buffering agent, and to pH 9 (alkaline) with sodium hydroxide. Express (400g/kg soluble form of GA) was added to the respective Urea solutions at 40.3g per 100 litres of water. 'Widespread' (non-ionic adjuvant) was added to all treatments (50mL per 100 litres of water).

The GA remained chemically stable (>98%) over a 24hour period at ambient temperatures over all pH/GA solutions tested.

This indicates Express can be tank mixed with dissolved Urea without significant degradation of GA over a 24hr period. In a practical sense, this allows adequate time for product application post mixing, under normal circumstances, without adversely affecting the GA stability and therefore ensuring maximum efficacy of the application.

Keywords: Liquid Urea, stability, Express, gibberellic acid, pH

Introduction

Gibberellic acid (GA) has been shown to increase pasture growth during periods when low soil temperatures limit pasture growth, namely early spring and late autumn, giving a feed deficit as the pasture growth rates are lower than animal demand (Bryant, 2012; Jiang, Carey, Roberts, & Kerse, 2011; Matthew, Hofman, & Osborne, 2009). The application of nitrogen, typically as Urea, is common practice at these times for the same purpose.

The use of Urea in conjunction with GA is desirable for maximum response, with trials showing additive effects where GA & Urea are applied together in solution (Bryant, 2012; Jiang, et al., 2011). There is concern about the stability of GA when tank mixed with dissolved Urea as the addition of Urea can increase the pH of the solution significantly, potentially affecting GA stability.

Methods

GA stability in Urea solutions was tested using HPLC (2% margin of error) over different time periods (0, 1, 3, 4, 5 and 24 hours post treatment). De-ionized water was used in all solutions.

Table 1: Specifications for the different treatments tested

	Solution	pH Adjusted	pH
1. Express	Water	No	6.1
2. Express + Liquid Urea	390g/L Urea	No	8.1
3. Express + Liquid Urea	390g/L Urea	Yes (Sodium Hydroxide)	9.0
4. Express + Liquid Urea	390g/L Urea	Yes (Synergy pH Buffer)	4.5

Express GA and Widespread non-ionic adjuvant were accessed from Ravensdown Fertiliser Co-Operative Ltd. De-ionized water and Auckland tap water were used for making the solutions. Sodium Hydroxide and Synergy pH Buffer was used to buffer pH.

A solution containing 390g per litre (18% w/v equivalent) of Urea was added to tap water and equilibrated to room temperature prior to use.

Sodium Hydroxide was added to the Urea solution until pH reached 9 in Trial 2A. Synergy pH Buffer was added to the Urea solution until the solution pH was 4.5 in Trial 3.

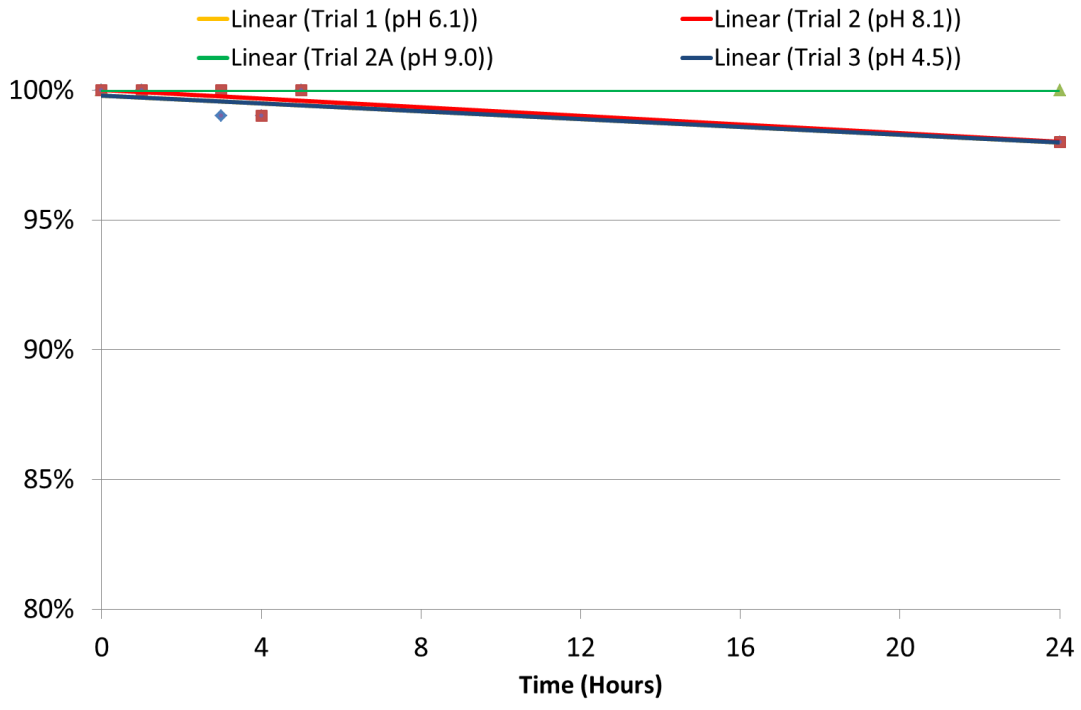
Express was added to the respective Urea solutions at 40.3g per 100 litres of water after pH adjustments, with Widespread being added at 50mL per 100 litres of water at the same time.

High Performance Liquid Chromatography (HPLC) was used to determine GA concentration at the 0, 1, 3, 4, 5 and 24 hour time points (except trial 2A which was 0 and 24 hours only).

Results

There was no significant loss of stability of GA over a 24hour period at ambient temperatures over the range of pH/GA solutions tested. Even when the solution was buffered to pH 4.5 there was no difference in GA degradation to the other pH levels tested (8.1 & 9), over 24 hours.

Figure 1: Gibberellic Acid Stability (% remaining) in a dissolved Urea solution with differing pH levels.



Discussion

The results of these tests indicate Express can be tank mixed with dissolved Urea (18% N w/v equivalent) without significant degradation of the active ingredient, GA, over a 24hr period. In a practical sense, this allows adequate time for product application post mixing, under normal circumstances, without adversely affecting the GA stability and therefore ensuring maximum efficacy of the application.

With previous work showing the advantages of using Urea and GA to achieve a higher response than either GA or Urea alone (Bryant, 2012), the application of Express and dissolved Urea together could reduce the applied cost and cost of extra pasture production (measured as cents/kg DM) to the farmer.

Further work to investigate the potential of increasing pasture response in terms of extra DM produced per Kg of N applied with combined applications of GA and Urea compared to Urea and Express applied alone. An economic analysis in terms of the cost in c/Kg of extra DM produced would also be of interest.

Further work could be based around the yield responses from the application of GA and dissolved Urea under different solution pH. There is evidence in fruit crops that a reduced solution pH enhances the GA absorption into the plant (Shulman, Fanberstein, & Bazak, 1987) and this may be relevant in agricultural pastures.

References

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