



**Target and Observed Ranges for Fermentation  
Legume Forage**

|  | Summary by Dry Matter Range |             |             |             |             |             |             |
|--|-----------------------------|-------------|-------------|-------------|-------------|-------------|-------------|
|  | TARGET                      | <30%        | 30%-36%     | 36%-40%     | 40%-46%     | 46%-52%     | 52%-60%     |
| pH   | 4.4 - 5.2                   | 4.4 - 5.3   | 4.4 - 5.3   | 4.4 - 5.2   | 4.4 - 5.2   | 4.5 - 5.4   | 4.7 - 5.6   |
| Titrateable Acidity                          | 2.5 - 6.5                   | 1.5 - 7.6   | 1.5 - 7.6   | 2.8 - 6.0   | 2.4 - 5.2   | 1.9 - 4.1   | 1.1 - 3.2   |
| Ammonia (CPE) %CP                            | 5.0 - 12.0                  | 5.4 - 17.0  | 5.4 - 16.9  | 5.0 - 13.1  | 4.4 - 11.4  | 4.0 - 9.9   | 3.4 - 9.1   |
| Total VFA                                    | 6.0 - 10.0                  | 6.7 - 11.1  | 6.6 - 11.1  | 5.9 - 10.2  | 4.8 - 9.0   | 3.4 - 7.4   | 1.6 - 5.4   |
| Lactic Acid % Total VFA                      | 60 - 80                     | 46.5 - 80.0 | 46.5 - 80.0 | 56.8 - 82.6 | 61.0 - 84.2 | 62.1 - 87.5 | 57.2 - 90.8 |
| <b>Lactic Acid and Volatile Fatty Acids:</b> |                             |             |             |             |             |             |             |
| Lactic Acid                                  | 3.5 - 7.5                   | 3.5 - 7.7   | 3.5 - 7.7   | 3.8 - 7.4   | 3.3 - 6.9   | 2.4 - 5.7   | 1.1 - 4.2   |
| Acetic Acid                                  | 1.5 - 3.0                   | 1.6 - 4.1   | 1.6 - 4.1   | 1.2 - 3.2   | 1.0 - 2.6   | 0.7 - 1.9   | 0.4 - 1.5   |
| Propionic Acid                               | 0 - 0.4                     | 0 - 0.7     | 0 - 0.7     | 0 - 0.4     | 0 - 0.3     | 0 - 0.2     | 0 - 0.2     |
| Butyric Acid                                 | <0.4                        | 0 - 1.6     | 0 - 0.6     | 0 - 0.9     | 0 - 0.7     | 0 - 0.5     | 0 - 0.5     |
| Iso-butyric Acid                             | <0.2                        | 0 - 0.6     | 0 - 0.6     | 0 - 0.6     | 0 - 0.2     | 0 - 0.1     | 0 - 0.6     |
| <b>Alcohols, Acetates, and Lactates:</b>     |                             |             |             |             |             |             |             |
| 1,2 propanediol                              | 0 - 0.5                     | 0 - 1.4     | 0 - 1.3     | 0 - 1.2     | 0 - 0.5     | 0 - 0.6     | 0 - 1.0     |
| 1-propanol                                   | <0.2                        |             |             |             |             |             |             |
| Methanol                                     | <0.2                        |             |             |             |             |             |             |
| Ethanol                                      | <0.2                        |             |             |             |             |             |             |
| 2-butanol                                    | <0.2                        |             |             |             |             |             |             |
| Methyl acetate                               | <0.2                        |             |             |             |             |             |             |
| Ethyl acetate                                | <0.2                        |             |             |             |             |             |             |
| Propyl acetate                               | <0.2                        |             |             |             |             |             |             |
| Ethyl lactate                                | <0.2                        |             |             |             |             |             |             |
| Propyl lactate                               | <0.2                        |             |             |             |             |             |             |



**Target and Observed Ranges for Fermentation  
Grass Forage**

| Summary by Dry Matter Range                  |             |             |             |             |             |             |             |
|--|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
|  | TARGET      | <30         | 30-36       | 36-40       | 40-46       | 46-52       | 52-60       |
| pH   | 4.1 - 4.8   | 4.1 - 5.2   | 4.1 - 5.0   | 4.1 - 5.2   | 4.3 - 5.2   | 4.5 - 5.3   | 4.7 - 5.5   |
| Titrateable Acidity                          | 2.8 - 7.1   | 2.3 - 7.8   | 2.6 - 7.8   | 2.1 - 5.9   | 1.3 - 4.6   | 1.0 - 3.7   | 0.5 - 3.4   |
| Ammonia (CPE) %CP                            | 3.5 - 13.0  | 2.6 - 21.0  | 3.8 - 13.3  | 3.7 - 11.6  | 3.4 - 10.4  | 3.2 - 9.6   | 2.6 - 8.3   |
| Total VFA                                    | 3.5 - 7.5   | 3.1 - 8.1   | 3.5 - 7.9   | 3.0 - 7.4   | 2.3 - 6.3   | 1.8 - 5.1   | 1.1 - 3.5   |
| Lactic Acid % Total VFA                      | 60.0 - 80.0 | 22.5 - 69.9 | 43.4 - 80.4 | 49.0 - 81.5 | 48.0 - 83.3 | 45.2 - 84.7 | 40.2 - 86.2 |
| <b>Lactic Acid and Volatile Fatty Acids:</b> |             |             |             |             |             |             |             |
| Lactic Acid                                  | 3.0 - 5.4   | 0.8 - 5.0   | 1.8 - 5.6   | 1.7 - 5.3   | 1.3 - 4.7   | 0.9 - 3.7   | 0.6 - 2.4   |
| Acetic Acid                                  | 1.0 - 2.4   | 1.3 - 3.4   | 1.0 - 2.6   | 0.8 - 2.2   | 0.6 - 1.9   | 0.4 - 1.6   | 0.3 - 1.3   |
| Propionic Acid                               | 0 - 0.4     | 0.1 - 1.3   | 0 - 0.5     | 0 - 0.3     | 0 - 0.3     | 0 - 0.1     |             |
| Butyric Acid                                 | <0.4        | 0 - 1.6     | 0 - 0.8     | 0 - 0.5     | 0 - 0.6     | 0.1 - 0.5   | 0.1 - 0.5   |
| Iso-butyric Acid                             | <0.2        | 0.1 - 0.6   | 0 - 0.9     | 0.1 - 0.1   | 0 - 0.4     | 0 - 0.2     |             |
| <b>Alcohols, Acetates, and Lactates:</b>     |             |             |             |             |             |             |             |
| 1,2 propanediol                              | 0 - 1.2     | 0 - 0.8     | 0 - 1.2     | 0.2 - 0.9   | 0.3 - 1.2   | 0 - 2.3     |             |
| 1-propanol                                   | <0.2        |             |             |             |             |             |             |
| Methanol                                     | <0.2        |             |             |             |             |             |             |
| Ethanol                                      | <0.2        |             |             |             |             |             |             |
| 2-butanol                                    | <0.2        |             |             |             |             |             |             |
| Methyl acetate                               | <0.2        |             |             |             |             |             |             |
| Ethyl acetate                                | <0.2        |             |             |             |             |             |             |
| Propyl acetate                               | <0.2        |             |             |             |             |             |             |
| Ethyl lactate                                | <0.2        |             |             |             |             |             |             |
| Propyl lactate                               | <0.2        |             |             |             |             |             |             |



**Target and Observed Ranges for Fermentation  
Small Grain Forage**

|  | Summary by Dry Matter Range |             |             |             |             |             |             |
|--|-----------------------------|-------------|-------------|-------------|-------------|-------------|-------------|
|  | TARGET                      | <30         | 30 - 36     | 36 - 40     | 40 - 46     | 46 - 52     | >52         |
| pH   | 3.8 - 4.9                   | 3.9 - 5.1   | 3.8 - 4.9   | 3.9 - 5.0   | 4.1 - 5.2   | 4.3 - 5.4   | 4.5 - 5.9   |
| Titrateable Acidity                          | 3.6 - 8.7                   | 3.4 - 10.2  | 3.9 - 9.5   | 3.4 - 7.6   | 2.7 - 5.9   | 1.7 - 4.4   | 0.5 - 2.8   |
| Ammonia (CPE) %CP                            | 4.9 - 14.7                  | 0.3 - 26.3  | 4.0 - 16.9  | 4.6 - 14.3  | 4.3 - 13.1  | 3.6 - 12.5  | 1.6 - 10.8  |
| Total VFA                                    | 5.2 - 10.0                  | 5.7 - 11.7  | 5.6 - 10.6  | 4.7 - 9.3   | 3.9 - 8.4   | 3.1 - 7.1   | 1.3 - 5.9   |
| Lactic Acid % Total VFA                      | 60.0 - 85.0                 | 38.8 - 83.2 | 57.3 - 85.4 | 57.1 - 86.0 | 58.6 - 87.3 | 59.1 - 87.9 | 46.4 - 89.9 |
| <b>Lactic Acid and Volatile Fatty Acids:</b> |                             |             |             |             |             |             |             |
| Lactic Acid                                  | 3.5 - 7.6                   | 2.7 - 8.1   | 3.7 - 7.9   | 3.1 - 7.1   | 2.7 - 6.5   | 2.2 - 5.4   | 0.8 - 4.5   |
| Acetic Acid                                  | 0.8 - 2.6                   | 1.0 - 3.9   | 0.9 - 2.8   | 0.7 - 2.4   | 0.6 - 2.1   | 0.4 - 2.0   | 0.4 - 2.4   |
| Propionic Acid                               | 0 - 0.4                     | 0.2 - 1.1   | 0 - 0.5     | 0 - 0.3     | 0 - 0.3     | 0 - 0.3     | 0 - 0.3     |
| Butyric Acid                                 | <0.4                        | 0 - 2.3     | 0 - 1.2     | 0.1 - 1.0   | 0.1 - 0.9   | 0.1 - 0.8   | 0.1 - 1.0   |
| Iso-butyric Acid                             | <0.2                        | 0.1 - 0.6   | 0 - 0.4     | 0 - 0.4     | 0 - 0.4     | 0 - 0.3     | 0 - 0.2     |
| <b>Alcohols, Acetates, and Lactates:</b>     |                             |             |             |             |             |             |             |
| 1,2 propanediol                              | 0 - 1.5                     | 0 - 2.5     | 0 - 2.3     | 0 - 1.6     | 0 - 1.8     | 0 - 0.6     | 0 - 0.5     |
| 1-propanol                                   | <0.2                        |             |             |             |             |             |             |
| Methanol                                     | <0.2                        |             |             |             |             |             |             |
| Ethanol                                      | <0.2                        |             |             |             |             |             |             |
| 2-butanol                                    | <0.2                        |             |             |             |             |             |             |
| Methyl acetate                               | <0.2                        |             |             |             |             |             |             |
| Ethyl acetate                                | <0.2                        |             |             |             |             |             |             |
| Propyl acetate                               | <0.2                        |             |             |             |             |             |             |
| Ethyl lactate                                | <0.2                        |             |             |             |             |             |             |
| Propyl lactate                               | <0.2                        |             |             |             |             |             |             |



**Target and Observed Ranges for Fermentation  
Sorghum Forage**

|  | Summary by Dry Matter Range |             |             |             |             |             |
|--|-----------------------------|-------------|-------------|-------------|-------------|-------------|
|  | TARGET                      | <30         | 30 - 36     | 36 - 40     | 40 - 46     | >46         |
| pH   | 3.8 - 4.8                   | 3.7 - 4.9   | 3.8 - 4.8   | 4.0 - 4.9   | 4.2 - 5.3   | 4.4 - 5.5   |
| Titrateable Acidity                          | 4.5 - 9.1                   | 6.4 - 13.1  | 4.3 - 9.0   | 3.6 - 6.8   | 2.6 - 5.2   | 1.6 - 4.1   |
| Ammonia (CPE) %CP                            | 6.3 - 14.2                  | 4.7 - 16.1  | 6.3 - 14.1  | 6.5 - 13.4  | 0 - 28.5    | 5.5 - 14.8  |
| Total VFA                                    | 3.8 - 8.7                   | 4.7 - 10.7  | 3.8 - 8.6   | 3.2 - 8.3   | 3.0 - 6.8   | 1.1 - 5.1   |
| Lactic Acid % Total VFA                      | 60.0 - 80.0                 | 28.0 - 76.4 | 31.4 - 82.3 | 31.8 - 77.9 | 16.7 - 73.6 | 27.0 - 90.4 |
| <b>Lactic Acid and Volatile Fatty Acids:</b> |                             |             |             |             |             |             |
| Lactic Acid                                  | 1.9 - 5.0                   | 2.0 - 6.0   | 1.9 - 5.0   | 1.7 - 4.7   | 0.9 - 3.9   | 0.5 - 3.0   |
| Acetic Acid                                  | 1.5 - 5.0                   | 1.9 - 6.4   | 1.5 - 5.0   | 1.4 - 4.9   | 1.6 - 4.6   | 0.6 - 4.1   |
| Propionic Acid                               | 0 - 0.7                     | 0 - 1.0     | 0 - 0.7     | 0 - 0.4     | 0 - 0.1     | 0 - 0.4     |
| Butyric Acid                                 | <0.4                        | 0 - 2.3     | 0 - 1.9     | 0 - 0.8     | 0 - 1.1     |             |
| Iso-butyric Acid                             | <0.2                        | 0 - 0.6     | 0 - 0.3     | 0 - 0.3     | 0 - 0.1     |             |
| <b>Alcohols, Acetates, and Lactates:</b>     |                             |             |             |             |             |             |
| 1,2 propanediol                              | 0 - 2.0                     | 0 - 3.0     | 0 - 2.9     | 0.2 - 2.5   |             | 0.5 - 0.7   |
| 1-propanol                                   | >0.2                        |             |             |             |             |             |
| Methanol                                     | >0.2                        |             |             |             |             |             |
| Ethanol                                      | >0.2                        |             |             |             |             |             |
| 2-butanol                                    | >0.2                        |             |             |             |             |             |
| Methyl acetate                               | >0.2                        |             |             |             |             |             |
| Ethyl acetate                                | >0.2                        |             |             |             |             |             |
| Propyl acetate                               | >0.2                        |             |             |             |             |             |
| Ethyl lactate                                | >0.2                        |             |             |             |             |             |
| Propyl lactate                               | >0.2                        |             |             |             |             |             |



**Target and Observed Ranges for Fermentation  
Corn Silage**

|   | Summary by Dry Matter Range |             |             |             |             |             |
|---|-----------------------------|-------------|-------------|-------------|-------------|-------------|
|   | TARGET                      | <30         | 30 - 35     | 35 - 40     | 40 - 45     | >45         |
| pH  | 3.6 - 4.2                   | 3.6 - 4.2   | 3.6 - 4.1   | 3.7 - 4.2   | 3.7 - 4.4   | 3.8 - 4.7   |
| Titratable Acidity                                  | 5.1 - 10.0                  | 3.1 - 13.3  | 5.7 - 11.5  | 4.2 - 9.4   | 2.9 - 6.9   | 2.0 - 5.0   |
| Ammonia (CPE) %CP                                   | 10.0 - 15.0                 | 10.1 - 18.7 | 11.2 - 19.9 | 11.3 - 20.1 | 11.0 - 19.7 | 8.1 - 14.8  |
| Total VFA   | 5.5 - 9.0                   | 5.4 - 10.4  | 5.4 - 9.5   | 4.5 - 8.3   | 3.4 - 7.0   | 1.9 - 6.2   |
| Lactic Acid % Total VFA                             | 60.0 - 80.0                 | 48.1 - 78.0 | 53.1 - 79.9 | 55.0 - 81.4 | 54.2 - 82.6 | 53.0 - 93.0 |
| <b><u>Lactic Acid and Volatile Fatty Acids:</u></b> |                             |             |             |             |             |             |
| Lactic Acid   | 3.5 - 6.3                   | 3.2 - 6.9   | 3.4 - 6.6   | 2.9 - 5.9   | 2.3 - 4.9   | 1.9 - 5.0   |
| Acetic Acid   | 2.0 - 3.3                   | 1.6 - 4.3   | 1.4 - 3.6   | 1.1 - 3.0   | 0.9 - 2.5   | 0.4 - 1.9   |
| Propionic Acid                                      | <0.4                        | 0 - 1.0     | 0 - 0.8     | 0 - 0.6     | 0 - 0.4     | 0 - 0.3     |
| Butyric Acid  | <0.1                        | 0 - 1.0     | 0 - 0.6     | 0 - 0.4     | 0 - 0.5     | 0 - 0.7     |
| Iso-butyric Acid                                    | <0.1                        | 0 - 0.4     | 0 - 0.1     | 0 - 0.2     | 0 - 0.2     | 0 - 0.1     |
| <b><u>Alcohols, Acetates, and Lactates:</u></b>     |                             |             |             |             |             |             |
| 1,2 propanediol                                     | 0 - 2.0                     | 0 - 3.0     | 0 - 2.5     | 0 - 2.0     | 0 - 1.6     | 0 - 1.4     |
| 1-propanol  | <0.2                        |             |             |             |             |             |
| Methanol  | <0.2                        |             |             |             |             |             |
| Ethanol   | <0.5                        |             |             |             |             |             |
| 2-butanol   | <0.2                        |             |             |             |             |             |
| Methyl acetate                                      | <0.2                        |             |             |             |             |             |
| Ethyl acetate                                       | <0.2                        |             |             |             |             |             |
| Propyl acetate                                      | <0.2                        |             |             |             |             |             |
| Ethyl lactate                                       | <0.2                        |             |             |             |             |             |
| Propyl lactate                                      | <0.2                        |             |             |             |             |             |



**Target and Observed Ranges for Fermentation  
High Moisture Ear Corn**

|   | Summary by Dry Matter Range |             |             |             |             |            |
|---|-----------------------------|-------------|-------------|-------------|-------------|------------|
|   | Target                      | <65         | 65 - 70     | 70 - 75     | 75 - 80     | >80        |
| pH  | 4.4 - 5.7                   | 3.9 - 4.8   | 4.0 - 4.9   | 4.2 - 5.3   | 4.7 - 6.0   | 5.3 - 6.3  |
| Titratable Acidity                                  | 1.5 - 3.0                   | 1.5 - 3.5   | 1.4 - 3.1   | 0 - 3.4     | 0 - 1.9     | 0 - 0.2    |
| Ammonia (CPE) %CP                                   | 2.0 - 10.0                  | 3.8 - 27.0  | 6.9 - 15.2  | 3.4 - 12.0  | 0 - 16.6    | 0 - 14.1   |
| Total VFA   | 1.5 - 3.0                   | 1.8 - 3.9   | 1.4 - 3.0   | 0.8 - 2.1   | 0 - 2.1     | 0 - 1.2    |
| Lactic Acid % Total VFA                             | 60.0 - 90.0                 | 44.5 - 88.0 | 46.6 - 85.8 | 50.0 - 88.5 | 51.0 - 93.2 | 23.8 - 100 |
| <b><u>Lactic Acid and Volatile Fatty Acids:</u></b> |                             |             |             |             |             |            |
| Lactic Acid   | 0.8 - 2.0                   | 1.0 - 2.8   | 0.8 - 2.1   | 0.5 - 1.4   | 0.2 - 1.0   | 0 - 0.1    |
| Acetic Acid   | 0 - 0.4                     | 0.3 - 1.5   | 0.3 - 1.2   | 0.1 - 0.9   | 0 - 1.3     | 0 - 0.6    |
| Propionic Acid                                      | 0 - 0.1                     | 0 - 0.2     | 0 - 0.1     | 0 - 0.1     | 0 - 0.2     | 0 - 0.2    |
| Butyric Acid  | <0.1                        | 0 - 0.4     | 0 - 0.2     | 0 - 0.2     |             |            |
| Iso-butyric Acid                                    | <0.1                        | 0 - 0.2     | 0 - 0.1     |             |             |            |
| <b><u>Alcohols, Acetates, and Lactates:</u></b>     |                             |             |             |             |             |            |
| 1,2 propanediol                                     | 0.1 - 0.3                   | 0.1 - 0.2   | 0 - 0.5     | 0 - 0.4     |             |            |
| 1-propanol  | <0.1                        |             |             |             |             |            |
| Methanol  | <0.1                        |             |             |             |             |            |
| Ethanol   | <0.5                        |             |             |             |             |            |
| 2-butanol   | <0.1                        |             |             |             |             |            |
| Methyl acetate                                      | <0.1                        |             |             |             |             |            |
| Ethyl acetate                                       | <0.1                        |             |             |             |             |            |
| Propyl acetate                                      | <0.1                        |             |             |             |             |            |
| Ethyl lactate                                       | <0.1                        |             |             |             |             |            |
| Propyl lactate                                      | <0.1                        |             |             |             |             |            |



**Target and Observed Ranges for Fermentation  
High Moisture Corn**

|   | Summary by Dry Matter Range |             |             |             |             |           |
|---|-----------------------------|-------------|-------------|-------------|-------------|-----------|
|   | TARGET                      | <65         | 65 - 70     | 70 - 75     | 75 - 80     | >80       |
| pH  | 3.9 - 5.0                   | 3.7 - 4.6   | 3.9 - 5.0   | 4.3 - 5.7   | 5.0 - 6.2   | 5.3 - 6.2 |
| Titrateable Acidity                                 | 1.0 - 1.5                   | 1.5 - 3.1   | 0.8 - 1.9   | 0.7 - 1.4   | 0.2 - 1.1   | 0.1 - 0.3 |
| Ammonia (CPE) %CP                                   | 2.2 - 6.7                   | 4.9 - 18.3  | 4.3 - 9.8   | 3 - 4.3     | 1.2 - 5.5   | 0 - 19.6  |
| Total VFA   | 1.0 - 1.5                   | 1.0 - 5.0   | 0.8 - 2.0   | 0.9 - 1.5   | 0.3 - 0.8   | 0.0 - 0.1 |
| Lactic Acid % Total VFA                             | 50.0 - 80.0                 | 59.9 - 92.6 | 77.3 - 92.8 | 71.8 - 90.3 | 46.5 - 84.7 |           |
| <b><u>Lactic Acid and Volatile Fatty Acids:</u></b> |                             |             |             |             |             |           |
| Lactic Acid   | 0.1 - 0.7                   | 0.8 - 3.8   | 0.7 - 1.6   | 0.7 - 1.2   | 0.1 - 0.6   |           |
| Acetic Acid   | 0.1 - 0.2                   | 0.1 - 1.4   | 0.1 - 0.3   | 0.1 - 0.3   | 0.1 - 0.2   | 0 - 0.1   |
| Propionic Acid                                      | <0.1                        | 0 - 0.2     | 0 - 0.1     |             |             |           |
| Butyric Acid  | <0.1                        |             | 0 - 0.2     |             |             |           |
| Iso-butyric Acid                                    | <0.1                        | 0 - 0.1     |             |             |             |           |
| <b><u>Alcohols, Acetates, and Lactates:</u></b>     |                             |             |             |             |             |           |
| 1,2 propanediol                                     | 0 - 0.5                     | 0.4 - 0.9   |             |             |             |           |
| 1-propanol  | <0.1                        |             |             |             |             |           |
| Methanol  | <0.1                        |             |             |             |             |           |
| Ethanol   | <0.5                        |             |             |             |             |           |
| 2-butanol   | <0.1                        |             |             |             |             |           |
| Methyl acetate                                      | <0.1                        |             |             |             |             |           |
| Ethyl acetate                                       | <0.1                        |             |             |             |             |           |
| Propyl acetate                                      | <0.1                        |             |             |             |             |           |
| Ethyl lactate                                       | <0.1                        |             |             |             |             |           |
| Propyl lactate                                      | <0.1                        |             |             |             |             |           |