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Full Length Research Paper

Effects of pelleting on fertilizer quality of quail litter

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The objectives of this work were to study the effects of a pelleting process on quail litter (QL) properties including basic physicochemical properties, nutrient contents and heavy metal contents. Results show that the pelleting process decreased variability in dry matter, electrical conductivity, urea N, K, Na, S, Fe, Cu and Cd contents. Dry matter content of pelleted QL showed correlation with several forms of N, including total N, ammonium N, nitrate N, organic N and urea N. The pelleted QL was clearly preferable to the fresh QL with regard to storage, handling, transport and field application. The results highlight a need to improve the pelleting process by minimizing variability in pH, total N, ammonium N, nitrate N and total P.

Key words: Bedding material, dry matter, fertilizer, manure, prediction.

INTRODUCTION

The Japanese quail (*Coturnix japonica*) belongs to the pheasant (Phasianidae) family and is considered a separate species from the common quail (Zynudheen et al., 2008). Since 20th century, it is known for meat and egg production (Iwamoto et al., 2008), quail production has become a prominent livestock industry in Thailand for the past 20 years (Suppadit et al., 2009). The total census of quail in 2009 was approximately 5.20 million (Department of Livestock Development, 2010). Between the starter and maturity states, 1,000 birds produce 0.704 tons of litter (Suppadit, 2009a), resulting in an estimated annual production of 3,600-3,700 tons of fresh quail litter (QL). Quail litter is a mixture of manure, bedding material, waste feed and feathers removed from quail houses, and has the potential to significantly affect environmental quality (Suppadit, 2000; Alkis and Celen, 2009). Improper management of QL can pollute the environment primarily by contaminating surface and ground water (Suppadit, 2008). However, QL has high nutrient contents when used as an organic fertilizer. Thus, nutrients, such as nitrogen, phosphorus and potassium will be recycled. Quail litter has traditionally been used as an amendment (Suppadit, 2005), but utilizing fresh QL directly in food crop production can lead to unacceptable residues associated with pathogens, parasites, fungi, heavy metals and noxious odor (Suppadit, 2008). It may have an adverse effect on the health of growers and consumers, and crop quality can be affected badly (Maliba et al., 2011).

To overcome these problems, pelleting QL was proposed. Pelleting is a process that eliminates microorganisms and odor in QL (Suppadit et al., 2008). Furthermore, pelleting can facilitate usage, storage, handling and transport management of the QL (Sultana et al., 2010). However, there is currently no information concerning the effects of pelleting on QL fertilizer quality. Therefore, this study has two aims: (1) to investigate the effects of pelleting on fertilizer quality characteristics and (2) to determine the effects of dry matter content on

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Table 1. Fertilizing values of fresh and pelleted QL.

Indicators	Fresh QL (Mean ± S.D.; *n* = 20)	Pelleted QL (Mean ± S.D.; *n* = 20)
Dry matter (% d.w.)	80.6 ± 4.70	88.9 ± 4.10
Electrical conductivity (dS m^{-1})	10.3 ± 2.36	11.8 ± 2.10
pH (H_2O)	8.10 ± 0.430	7.70 ± 0.540
Ash (% d.w.)	20.0 ± 0.190	20.6 ± 0.340
Organic C (% d.w.)	37.8 ± 1.10	36.9 ± 1.40
Total N (% d.w.)	5.94 ± 0.450	5.16 ± 0.780
C/N ratio	6.35 ± 0.540	7.15 ± 0.560
Ammonium N (% d.w.)	0.500 ± 0.0500	0.496 ± 0.0600
Nitrate N (% d.w.)	0.295 ± 0.0400	0.294 ± 0.0300
Organic N (% d.w.)	4.86 ± 0.460	4.18 ± 0.730
Urea N (% d.w.)	0.185 ± 0.0200	0.180 ± 0.0300
Total P (% d.w.)	1.80 ± 0.300	1.75 ± 0.200
K (% d.w.)	3.25 ± 0.400	3.16 ± 0.380
Ca (% d.w.)	3.64 ± 0.630	3.48 ± 0.480
Mg (% d.w.)	0.630 ± 0.110	0.590 ± 0.120
Na (% d.w.)	1.46 ± 0.340	1.42 ± 0.230
S (% d.w.)	0.710 ± 0.0300	0.700 ± 0.0400
Fe (mg/kg)	755 ± 210	762 ± 184
Mn (mg/kg)	330 ± 34.8	324 ± 24.4
B (mg/kg)	20.4 ± 2.30	18.8 ± 2.26
Cu (mg/kg)	60.2 ± 10.2	58.8 ± 6.60
Zn (mg/kg)	256 ± 26.0	254 ± 20.6
Cd (mg/kg)	2.98 ± 0.380	2.97 ± 0.340
Ni (mg/kg)	0.490 ± 0.0100	0.480 ± 0.0200
Pb (mg/kg)	0.480 ± 0.0200	0.495 ± 0.0400
Cr (mg/kg)	11.0 ± 2.20	10.8 ± 2.30

Characteristics of the rice hull used as bedding material on the Siriwan Co. Ltd. network farms: dry matter, 92.1 %; pH, 6.58; total C, 36.5% d.w.; total N, 0.510% d.w.; C/N ratio, 71.2; P, 0.00180% d.w.; K, 0.285% d.w.; Ca, 0.158% d.w.; Mg, 0.100% d.w.; Na, 0.256% d.w.; S, 0.0680% d.w.; Fe, 105 mg/kg; Mn, 422 mg/kg; Co, 2.79 mg/kg; Cu, 2.58 mg/kg; Zn, 22.7 mg/kg; Cd, <0.190 mg/kg; Ni, <0.100 mg/kg; Pb, <0.100 mg/kg; Cr, 10.6 mg/kg.

chemical properties of QL.

MATERIALS AND METHODS

Preparation of experimental QL

Quail litter, which was obtained from the Siriwan Co. Ltd. network of Japanese quail farms in Saraburi Province, Thailand, consists of concrete-floored and open houses with a stocking density of 50.0 birds/m^2. At the beginning of each 30-day production cycle, the floor was covered with 5.00-5.50 kg/m^2 of rice (*Oryza sativa* L.) hull, which remained until the quail, of unsorted sexes, reached maturity. Rice hull is a by-product of rice growing and is widely used in quail farms in Thailand; it is high in silica and is an important source of carbon in QL, which is used as fertilizer (Pongpiachan, 1999). It has a near-neutral pH, high C/Nratio, and relatively high Fe, Mn, Zn and Cr concentrations (Table 1). At the end of each production cycle, after removal of the birds for distribution to general farms, the QL was removed with a loading shovel and piled under a plastic cover. The floor was washed, cleaned and disinfected, and then fresh rice hull was placed for the next cycle.

In this study, the sampling period of QL was from February to September 2010. After removal with a loading shovel, samples were immediately collected at the end of four production cycles from all five houses; a composite sample was prepared, and 10.0 kg of each group of twenty samples was taken from each pile at 75.0-100 cm deep. Twenty working samples (200 kg) were collected from four cycles of the five houses.

The QL removed at the end of each production cycle was processed based on the methods of Suppadit (2000). A Siriwan Model Machine located at Siriwan Co. Ltd., Thatoom Sub-district, Kaeng Khoi District, Saraburi Province, Thailand, was used for pelleting according to the procedures of Suppadit and Panomsri (2010). Fresh litter was transferred to a screw conveyer, moved into a receiving elevator, and placed into the pelleting chamber. The litter was fed between the die and rollers, and as the rollers turned, the litter was then forced into holes to produce the pellets. The movement of the rollers and die during the compression process generated heat and temperature of more than 90°.0°C in the QL pellets after being released from the die. The pelleting technology molds QL into cylindrical pellets that are 6.00 mm in diameter and 1.50-2.00 cm in length. Twenty samples in pelleted form were collected every 15 s during the pelleting process.

Fertilizing quality analyses

Samples of fresh and pelleted QL were sent to the laboratories of Chiang Mai Field Crops Research Center and Thailand Institute of Scientific and Technological Research. Subsamples of fresh and pelleted QL were oven dried at 65.0-70.0°C for 24 hours for moisture and dry matter determination. The remaining fresh QL was air dried and passed through a 2.00-mm-mesh sieve to remove feather fragments. The remaining pelleted QL was ground to a particle diameter of approximately 2.00 mm.

Physicochemical properties, nutrient content and heavy metal content of fresh and pelleted QL were analyzed according to the procedures in the Land Development Department Manual (2004). Electrical conductivity and pH were determined in 1.00:10.0 solid-to-water extracts using a conductivity meter and a pH meter, respectively (Peverill et al., 1999). Ash content was determined by combustion in a porcelain dish (Greweling and Peech, 1960), and organic C content was determined based on the methods of Walkley and Black (1947). Total N and S content was determined based on the Dumas method (Jackson, 1967), and ammonium (NH_4-N), nitrate (NO_3-N), organic N and urea N content was determined using AOAC standard methods (AOAC, 1970; 1980). Total P content was determined using the molybdenum blue method (Chapman and Pratt, 1961), and K, Ca, Mg, Na, Fe and Mn content was determined based on atomic emission/absorption spectrophotometry (Thomas et al., 1967). B content was determined using the azomethine-H method (Wolf, 1974), and Cu, Zn, Cd, Ni, Pb and Cr content was determined using atomic absorption spectrophotometry (Tessier et al., 1979).

Statistical analysis

Data were analyzed by analysis of variance for normally distributed data or by Kruskal-Wallis analysis and Mann-Whitney *U* tests for non-normally distributed data. Linear regression analysis was used to investigate the possible utility of dry matter content as a predictor of nutrient content. All analyses were performed with the statistics package SPSS 15.0 (Leech et al., 2007).

RESULTS AND DISCUSSION

Characteristics of fresh and pelleted QL

For fresh QL, total N content was high (5.94% dry weight), and the N:P:K ratio was 3.30:1.00:1.80 (Table 1). Nitrogen levels in the QL were likely due to feed management at the network farms of Siriwan Co. Ltd., as protein content in the feed was 24.0% at all stages (30 days) of the production cycle. Organic N concentration in fresh QL was high (81.8%), which is in line with the earlier report of Suppadit (2008), who investigated fresh QL from different 20 farms (80.2-84.8%) in Saraburi Province, Thailand. Because of the low C/N ratio (6.35), this organic N can be considered easily mineralizable (Alexander, 1991; Lopez-Mosquera et al., 2008). Most inorganic N was ammonium N (0.500%), which agrees with the study of Suppadit (2009b) in broiler litter (0.440-0.560%). Although there were differences in physiological, seasonal, environmental and management factors that may affect QL quality characteristics, the results of the present study were similar to those obtained in previous reports of Suppadit (2008): dry matter (75.8-85.8%), electrical conductivity (6.55-12.8 dS/m), pH (6.36-8.54), ash (10.4-36.5%), organic C (30.3-39.0%), total N (5.03-6.40%), C:N ratio (5.80-9.80), ammonium N (0.450-0.950%), nitrate N (0.100-0.340%), organic N (1.90-5.38%), urea N (0.160-0.920%), total P (0.420-2.50%), K (0.170-3.67%), Ca (0.920-5.20%), Mg (0.220-0.860%), Na (0.820-1.80%), S (0.240-0.810%), Fe (540-2,850 mg/kg), Mn (175-480 mg/kg), B (14.2-109 mg/kg), Cu (25.0-380 mg/kg),Zn (11.0-30.0 mg/kg), Cd (2.30-3.40 mg/kg), Ni (0.360-19.0 mg/kg), Pb (0.400-15.2 mg/kg), and Cr (8.20-13.40 mg/kg).

Pelleted QL met the primary characteristics of organic fertilizer under the specification of the Land Development Department Manual (2004): dry matter, > 65.0%; organic C, > 17.4%; C/N ratio, 3.0-15.0; organic N, > 2.00%; total P, > 0.44%; K, > 0.83%; Cu, < 450 mg/kg; and Zn, < 1,100 mg/kg (Table 1). Pelleted QL had high N (5.16% dry weight, with 81.0% as organic N), P (1.75%) and K (3.16%) contents, and had an N:P:K ratio of 2.95:1.00:1.80. In pelleted QL, most of the inorganic N was ammonium N (0.496%). The low C:N ratio (7.15) was related to the high N content, and similar to the fresh QL, the organic N (4.18%) can thus be considered readily mineralizable. These results show that pelleted QL is a high quality fertilizer that meets all the requirements of an organic fertilizer, even though some components could be denatured by heat during the pelleting process (~90°.0°C). However, heat and pressure from the pelleting process occurred only for a short period (~5-10 s) (Suppadit and Panomsri, 2010). Furthermore, the low moisture content (88.9% dry matter) of pelleted QL greatly reduced noxious odors. Heavy metal contents (Cd, 2.97 mg/kg; Ni, 0.480 mg/kg; Pb, 0.495 mg/kg; Cr, 10.8 mg/kg) in all samples of pelleted QL were much lower than the allowable maximum values for organic fertilizer (Cd, < 3.50 mg/kg; Ni, < 120 mg/kg; Pb, < 150 mg/kg; Cr, < 270 mg/kg) (The Land Development Department, 2004). These results show that pelleted QL is acceptable for fertilizer use.

Variability among the production cycles

There was an increase in variability due to stock-related

Table 2. Temporal variability among the four production cycles in fresh and pelleted QL.

Varieties	Indicators	*F* or X^2 value, fresh QL	*F* or X^2 value, pelleted QL
No significant variability in either product	Ash	$F = 0.190^{n.s.}$	$X^2 = 7.78^{n.s.}$
	Organic C	$X^2 = 7.00^{n.s.}$	$X^2 = 8.84^{n.s.}$
	Total N	$F = 3.76^{n.s.}$	$F = 5.40^{n.s.}$
	Ca	$F = 5.10^{n.s.}$	$F = 2.06^{n.s.}$
	Mg	$F = 5.35^{n.s.}$	$F = 5.02^{n.s.}$
	Mn	$F = 4.33^{n.s.}$	$F = 3.84^{n.s.}$
	B	$F = 0.880^{n.s.}$	$F = 2.72^{n.s.}$
	Zn	$F = 4.76^{n.s.}$	$F = 3.19^{n.s.}$
	Ni	$F = 6.19^{n.s.}$	$F = 4.65^{n.s.}$
	Pb	$F = 1.16^{n.s.}$	$F = 1.34^{n.s.}$
	Cr	$F = 6.28^{n.s.}$	$F = 8.87^{n.s.}$
Significant variability in both products	C/N ratio	$F = 6.68^{*}$	$F = 9.96^{*}$
Significant variability in fresh but not in pelleted QL	Dry matter	$F = 194^{*}$	$F = 9.60^{n.s.}$
	Electrical conductivity	$F = 120^{*}$	$F = 4.00^{n.s.}$
	Urea N	$F = 91.8^{*}$	$F = 7.74^{n.s.}$
	K	$F = 6.80^{*}$	$F = 3.52^{n.s.}$
	Na	$F = 27.6^{*}$	$F = 1.00^{n.s.}$
	S	$F = 79.8^{*}$	$F = 5.66^{n.s.}$
	Fe	$F = 7.74^{*}$	$F = 0.780^{n.s.}$
	Cu	$F = 8.40^{*}$	$F = 2.05^{n.s.}$
	Cd	$F = 8.84^{*}$	$F = 2.28^{n.s.}$
Significant variability in pelleted but not in fresh QL	pH	$X^2 = 9.90^{n.s.}$	$F = 792^{*}$
	Total N	$F = 5.16^{n.s.}$	$F = 7.60^{*}$
	Ammonium N	$X^2 = 6.44^{n.s.}$	$F = 20.2^{*}$
	Nitrate N	$X^2 = 8.90^{n.s.}$	$F = 24.8^{*}$
	Total P	$X^2 = 4.36^{n.s.}$	$F = 7.35^{*}$

* = Significant variability (P<0.05); n.s. = no significant difference (P>0.05).

Factors ((variety, season, environment), as well as related to feeding, litter and losses of nutrients, especially N (Lopez-Mosquera et al., 2008). To determine the suitability of pelleted QL as a fertilizer, variability of quality characteristics of fresh and pelleted QL among the four consecutive production cycles was investigated (Table 2). The results of this analysis suggest that the ash, organic C, total N, Ca, Mg, Mn, B, Zn, Ni, Pb and Cr contents did not show significant variability in either fresh or pelleted QL. One indicator, the C/N ratio, showed significant variability in both products. Dry matter, electrical conductivity, urea N, K, Na, S, Fe, Cu and Cd showed significant variability in fresh but not pelleted QL, whereas pH, total N, ammonium N, nitrate N and total P showed significant variability only in pelleted QL. These findings are similar to those reported in broiler litter (Lopez-Mosquera et al., 2008; Suppadit, 2009b). As noted, the pelleting process decreased the variability in nine indicators, however, it increased variability in five indicators (pH, total N, ammonium N, nitrate N and total P).

This is possibly due to variability in the temperature during the pelleting process; thus, it may be important to tightly control this factor. The pressing pelleting and high temperature could probably be important for nitrogen, because NH_3 volatilization increases exponentially at higher temperature (Wood and Hall, 1991; Lopez-Mosquera et al., 2008; Suppadit et al., 2008; Suppadit,

Table 3. Differences in properties between fresh and pelleted QL.

Varieties	Indicators	*F* or *U* value (difference between QL comparisons)	Pelleted vs. fresh (difference between means)
No temporal variability	Ash (% d.w.)	$F = 1.68^{n.s.}$	+ 0.600
	Organic C (% d.w.)	$U = 26.4$*	- 0.900
	Total N (% d.w.)	$F = 13.8$*	-0.780
	Ca (% d.w.)	$F = 0.290^{n.s.}$	-0.160
	Mg (% d.w.)	$F = 2.16^{n.s.}$	-0.0400
	Fe (mg/kg)	$F = 19.6$*	+ 7.00
	Mn (mg/kg)	$U = 6.10$*	-6.00
	B (mg/kg)	$F = 29.8$*	-1.60
	Zn (mg/kg)	$F = 0.280^{n.s.}$	-2.00
			-
Temporal variability	Dry matter (% d.w.)	$F_{min} = 776$* (3 cycles)	+ 8.30
	Electrical conductivity (dS m^{-1})	$F_{max} = 11.8^{n.s.}$	+ 1.50
	pH	$F_{min} = 990$* (3 cycles)	-0.400
	C/N ratio	$F_{max} = 15.0^{n.s.}$	+ 0.800
	Ammonium N (% d.w.)	$F_{max} = 4.16^{n.s.}$	-0.00400
	Nitrate N (% d.w.)	$F_{max} = 5.20^{n.s.}$	-0.00100
	Organic N (% d.w.)	$F_{max} = 12.4^{n.s.}$	-0.680
	Urea N (% d.w.)	$F_{max} = 5.92^{n.s.}$	-0.00500
	Total P (% d.w.)	$F_{max} = 1.53^{n.s.}$	-0.0500
	K (% d.w.)	$F_{max} = 15.0^{n.s.}$	-0.0900
	Na (% d.w.)	$F_{max} = 6.90^{n.s.}$	-0.0400
	S (% d.w.)	$F_{max} = 2.40^{n.s.}$	-0.0100
	Cu (mg/kg)	$F_{max} = 8.30^{n.s.}$	-1.40
	Cd (mg/kg)	$F_{max} = 7.80^{n.s.}$	-0.0100
	Ni (mg/kg)	$F_{max} = 6.70^{n.s.}$	-0.0100
	Pb (mg/kg)	$F_{min} = 12.6$* (3 cycles)	+ 0.0150
	Cr (mg/kg)	$F_{max} = 6.80^{n.s.}$	-0.200

For indicators not showing temporal variability (see Table 2), the two QL products were compared by considering the samples obtained from the four different cycles simply as replicates (*n* = 20). For indicators showing temporal variability, comparisons were made cycle by cycle (*n* = 5 in each case), and an overall significant difference between the fresh and pelleted QL was defined to be present when significant differences were detected in two or more of the four cycles. For these latter indicators, the value shown is the maximum *F* value for non-significant comparisons, or the minimum *F* value for significant comparisons, with the number of individual significant values in bracket. * = Significant variability (P<0.05); $^{n.s.}$ = no significant difference (P>0.05).

2009b).

Effects of the pelleting process

There was a difference in the mean quality characteristics between fresh and pelleted QL(Table).The pelleting process decreased moisture contents by more than 42.8%, from an average of 19.4% (80.6% dry matter) in fresh QL to an average of 11.1% (88.9% dry matter) in pelleted QL. Decreased moisture content and the associated volume reduction from the pelleting method is convenient for the storage, handling, transportation and application of pelleted QL. Furthermore, fresh QL typically poses risks of several environmental problems, including N emission to the atmosphere and leaching into the groundwater (Sims and Wolf, 1994; Lopez-Mosquera et al., 2008; Suppadit, 2009a). The pelleting process led to a significant reduction in organic C and especially large reduction in total N content, although the C/N ratio was not significantly affected. On average, pelleted QL showed less organic C content (2.38%) and total N content (13.1%) compared to fresh QL. These reductions probably reflect the high temperature (~90°.0^{o}C) to which the fresh QL was subjected. Lopez-Mosquera et al. (2008) also detected a significant reduction of organic C -

Table 4. Results of linear regressions with dry matter as a candidate predictor variable and chemical properties as dependent variables.

QL	Regression equation [n = 20 (5 houses × 4 cycles)]	r^2	F value	P value
Fresh	Total N = -6.68×10^{-3} DM + 6.20	0	0.0200	0.840
Pelleted	Total N = $-0.220 \times$ DM + 24.2	0.730	17.1	0.00100
Fresh	Organic N = -3.10×10^{-2} DM + 7.30	0.0400	0.260	0.550
Pelleted	Organic N = $-0.190 \times$ DM + 20.4	0.720	14.5	0.00300
Fresh	Ammonium N = 1.15×10^{-2} DM - 0.360	0.210	2.76	0.140
Pelleted	Ammonium N = -1.40×10^{-2} DM + 1.72	0.800	16.2	0.00300
Fresh	Urea N = 5.38×10^{-3} DM - 0.220	0.460	7.90	0.0520
Pelleted	Urea N = -9.30×10^{-3} DM + 1.08	0.770	20.5	0.00100
Fresh	Nitrate N = 3.63×10^{-3} DM + 0.0100	0.230	2.79	0.100
Pelleted	Nitrate N = -10.4×10^{-3} DM + 1.23	0.750	22.2	0.00400
Fresh	Total P = -3.24×10^{-2} DM + 4.10	0.160	2.28	0.122
Pelleted	Total P = -1.32×10^{-2} DM + 2.88	0.0600	0.420	0.630
Fresh	K = 6.32×10^{-2} DM - 1.46	0.240	3.69	0.100
Pelleted	K = -8.05×10^{-2} DM + 10.1	0.330	4.16	0.0800
Fresh	Mg = 1.26×10^{-2} DM - 0.280	0.280	5.10	0.0500
Pelleted	Mg = -9.30×10^{-3} DM + 1.38	0.110	1.36	0.350
Fresh	S = -3.77×10^{-3} DM + 0.890	0.210	3.35	0.0890
Pelleted	S = 3.52×10^{-3} DM + 0.36	0.220	2.69	0.160

in fresh broiler litter after it was heated to 60.0-80.0°℃. It is well known that total N losses increase with increasing pelleting temperature, largely as a result of NH_3 volatilization (Gale et al., 1991; Wood and Hall, 1991; Lopez-Mosquera et al., 2008; Suppadit et al., 2008; Suppadit,22009b).However,no difference in ammonium N, nitrate N, or urea N were detected between the fresh and the pelleted QL. The pH remained at basic level but was lower in the pelleted QL (pH, 7.70) than in the fresh QL (pH, 8.10). Oxidation of organic matter causes acidification (McBride, 1994); thus, the decrease in pH was possibly due to release of H^+ that is associated with organic anions during pelleting (Lopez-Mosquera et al., 2008). The alkalinity of pelleted QL makes it particularly suitable for acidic soil areas as they are common particularly in the humid tropics including Thailand (Suppadit, 2009a).

In this study, increase in temperature to 90°.0°C led to significant reductions in Mn and B contents in the pelleted QL compared to fresh QL. This finding is consistent with the study of Lopez-Mosquera et al. (2008) and Suppadit (2009b), who showed that B, Mn, Cu, Cr and Cd contents of broiler litter were affected by pelleting temperatures of up to 90°.0°C. In this study, Fe and heavy metals (Pb) increased, whereas moisture content decreased, which is consistent with a previous study in broiler litter (Suppadit et al., 2008) and could have resulted from contamination by the apparatus or machine oil used in the pelleting process as found in the previous studies of Lopez-Mosquera et al. (2008) and Suppadit (2009b).

Fertilizer quality prediction

Results of linear regression on fertilizing quality, in both fresh and pelleted QL, are shown in Table 4. This analysis was performed as a comparison to the previous study of Nicholson et al. (1996), who suggested that dry matter content of litter is a good predictor of total N, P, K, Mg and S content, expressed as fresh broiler litter weight. In this study, dry matter content of pelleted QL was a good predictor only for the content of various nitrogen compounds, but not for other indicators. The finding is consistent with previous studies of broiler litter (Lopez-Mosquera et al., 2008; Suppadit 2009b) and suggests that simple determination of dry matter content could be effective for estimating total N content (ammonium N, nitrate N, organic N, urea N) of pelleted QL. This may be particularly valuable as a basis for rapid quality-control tests during the pelleting process.

Conclusions

Pelleted QL has high fertilizer quality and meets all requirements as an organic fertilizer. Some components may be slightly denatured due to the short period (~5-10 s) of high temperature and pressure that occurs during the pelleting process. However, pelleted QL has more appropriate fertilizer quality characteristics than fresh QL. Furthermore, the pelleting process is convenient for the storing, handling, transporting and field application of QL.

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