**The role of crop residues and olive by products in filling the deficit of animal feedstuffs in Palestine**

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**Introduction**

The animal production sector in Palestine generates more than 4% of GDP of the total agriculture income; this field is generally composed of 732.399 heads of sheep and goat and 39.625 of cattle (PCBS, 2010).

A major constraint to livestock production in Palestine is the scarcity and fluctuating quantity and quality of the year-round feed supply. Providing adequate good quality feed to livestock to raise and maintain their productivity is, and will continue to be, a major challenge to agricultural scientists and policy makers all over the world.

However, a shortage of affordable feeds of adequate quality and quantity, particularly during the dry season is a major obstacle to improving production.

To overcome this vital problem many attempts were made, such as utilization of agriculture and industrial by-products.

The non-conventional feed resources (NCFR) refer to all those feeds that have not been traditionally used in animal feeding and or are not normally used in commercially produced rations for livestock. Defined in this manner the NCFR embrace a wide diversity of feeds that are typical of, and abundant in, the Region.

Huge amounts of agriculture and industrial by-products are produced in Palestine but most of which are not fully used in animal feeding and contribute to the environment pollution. (Table 1)



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**Objectives**

Create technical conditions to reduce the high costs of feeding livestock by joint research and extension services to farmers to utilize agricultural and industrial by-products

**Methodology**

The most-effective way to improve animal feed resources through the rational use of locally available agricultural and industrial-by products likely to be available to small-scale farmers at village level.

Different solutions are available for treatment of these by product which describes methods for upgrading nutritional, storage, and handling qualities of by-products for improving their performance of animals. silage making, feed block, hay feeding after urea treatment , are the most methods which can be used for treatments of byproducts in Palestine

Different approaches to improve the nutritive value of olive cake have been tested. De-stoning (manual removal of crushed seeds), ensiling pelleting, and exogenous fibrolytic enzymes have been investigated. Chemical treatment of olive cake with alkali or oxidizing compounds (i.e., NaOH and anhydrous ammonia) is another approach

**Chemical composition of olive cake before treated**

Unlike other oil cakes, crude olive cake has a low crude protein and high crude fibre content. It retains a relatively high fat content. Exhaustion by solvent extraction decreases its fat content and relatively increases its other contents. Partial desto ning by screening or ventilation lowers its crude fibre content. (Table 2).

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| Table 2: Indicative chemical composition of different olive cake types | | | | | |
|  |  | **% of dry matter** | | | |
| **Type** | **Dry matter** | **Ash** | **Crude Protein** | **Crude Fibre** | **Ether Extract** |
| Crude olive cake | 75–80 | 3–5 | 5–10 | 35–50 | 8–15 |
| Partly destoned olive cake | 80–95 | 6–7 | 9–12 | 20–30 | 15–30 |
| Exhausted olive cake | 85–90 | 7–10 | 8–10 | 35–40 | 4–6 |
| Partly destoned exhausted |  |  |  |  |  |
| olive cake | 85–90 | 6–8 | 9–14 | 15–35 | 4–6 |
| Fatty pulp | 35–40 | 5–8 | 9–13 | 16–25 | 26–33 |

Sources: many author

**Results**

**improving nutritive value of olive cake**

**Soda treatment**

Small quantities of soda less than 4 percent, have only slight effect on in vitro digestibility of dry matter. The latter increases progressively, reaching levels of 50 to 70 percent for 6 to 8 percent quantities of soda, (Abdouli, 1979; Nefzaoui, 1979). Washing and filtering of olive cake to eliminate excessive soda decrease digestibility.(table 3)

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| Table 3: Average cell wall constituents of exhausted screened olive cake untreated or treated with 4 percent soda (6 percent of DM) | | |
|  | **Untreated** | **Treated (6% NaOH/DM)** |
| NDF | 60.1 | 47.2 |
| ADF | 49.9 | 38.8 |
| Corrected ADL | 26.8 | 17.5 |
| Hemi-cellulose | 10.2 | 8.3 |
| Cellulose | 23.1 | 21.3 |
| Total ADF-N/N, % | 94.9 | 74.6 |

**Ensilage with alkalis**

Micro-silo (table 4) studies showed considerable in situ improvement of digestibility with large doses of soda (8%) which was higher than that obtained with ammonia

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| Table 4: In situ digestibility of alkali-treated exhausted screened olive cake silage (Nefzaoui, A. et al, 1982) | | | | |
| **Apparent digestibility coefficient** | **DM** | **OM** | **ADF** | **CP** |
| Control | 51.68 | 51.23 | 36.73 | 59.32 |
| Ammonia 2% | 60.25 | 61.53 | 45.88 | 81.34 |
| Ammonia 4% | 58.32 | 60.36 | 38.89 | 83.80 |
| Ammonia 6% | 63.04 | 63.86 | 48.18 | 86.90 |
| Ammonia 8% | 64.28 | 65.34 | 49.87 | 89.54 |
| Soda 4% | 62.86 | 62.00 | 46.63 | 72.84 |
| Soda 6% | 62.46 | 60.55 | 47.17 | 73.93 |
| Soda 8% | 78.51 | 77.67 | 62.04 | 79.35 |

**Ensilage with Ammonia treatment**

* Exhausted screened olive cake with molasses added previously was stored in plastic bags with an injection of NH3 (3%). The result was a considerable improvement of nutritive value (Table 5)

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| Table 5: Digestibility, intake and protein balance of exhausted screened olive cake ensiled with ammonia [\*](http://www.fao.org/docrep/003/X6545E/X6545E02.htm#note12*) (Nefzaoui, A. et al, 1983) | | |
|  | **Untreated olive cake** | **Treated 3% NH3** |
| Digestibility (%) |  |  |
| DM | 36 | 41 |
| OM | 40 | 43 |
| CP | 29 | 55 |
| EE | 77 | 86 |
| CF | 39 | 49 |
| NDF | 32 | 39 |
| ADF | 25 | 32 |
| ADL | 13 | 19 |
| Hemi-cellulose | 60 | 63 |
| Cellulose | 43 | 49 |
| Intake g DM/d/P0.75 | 99 | 98 |
| Protein balance: g N/d/P0.75 |  |  |
| Ingested | 1.903 (100%) | 3.610 (100%) |
| Faecal | 1.353 (71%) | 1.632 (45%) |
| Urinary | 0.240 (13%) | 1.147 (32%) |
| Retained | 0.310 (16%) | 0.831 (23%) |

**Treatment with Na2 CO3**

Vaccarino et al (1982) compared treatments with different doses of NaOH and Na2CO3 on partly destoned olive cake at 70° C during 150 minutes before adding solvent. Both methods improved digestibility in vitro considerably; however, soda proved the most effective (Table 6).

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| Table 6: Effects of treatment of partly destoned olive cake with NaOH or Na2CO3 on in vitro digestibility (Vaccarino et al, 1982) | | | | | | | |
|  | **Control** | **NaOH, %** | | | **Na2 CO3, %** | | |
| **2.9** | **5.7** | **8.6** | **3.8** | **7.2** | **11.4** |
| Digestibility of |  |  |  |  |  |  |  |
| Org. Mat. | 15.8 | 20.7 | 32.3 | 50.8 | 26.9 | 40.6 | 47.9 |
| Digestibility of |  |  |  |  |  |  |  |
| dry matter | 9.7 | 8.8 | 27.2 | 31.9 | 5.1 | 39.4 | 46.5 |

## Conclusions

1. Olive cake is a rough ligno-cellulose feed because of:
   * its high fibre (NDF), ADF and lignin contents;
   * its low crude protein contents;
   * the poor digestibility of its dry matter and crude protein;
   * its acetic type of fermentation in the rumen;
   * the feeding and ruminating behavior of animals consuming it.
2. Olive cake probably contains no toxic or inhibiting substances. Its poor digestive and metabolic utilization is probably due mainly to its high degree of lignifications and to the technological process for oil extraction in which it is frequently subjected to high heat.
3. Distributed alone:
   * it is not palatable (on the other hand the addition of 8–10% molasses can result in a high intake level);
   * it causes weight losses in the animals;
   * it is poorly digested;
   * it causes low ammonia and volatile fatty acid production, a proof of its low nutritive value.
4. The tegument and shells have low digestibility. Screening, which eliminates part or all of the stones, improves the nutritive value of olive cake. Intensive screening, leaving only a very light product consisting mainly of the tegument would have the opposite effect. The screening operation should retain fragments of the crushed kernel which are especially rich in proteins and have high digestibility.
5. Its use without any previous treatment can ensure:
   * Normal performances (lamb fattening) when incorporated at levels below 30 or 40 percent and with sufficient proteins and minerals added;
   * Maintenance or survival of cattle in difficult conditions when incorporated at higher levels (70 percent).
6. Treatment can improve the nutritive value of olive cake:
   * Development of industrial treatment with soda in spite of some improvement is still limited since the investments involved are high.
   * Treatment with 6 to 8 percent doses of soda through ensilage would be effective but also too costly.
   * Ammonia treatment (ensilage) would be more promising, since it would improve digestibility and provide an additional protein supply.
7. Supplementing olive cake by a good quality and low cost protein source would undoubtedly be profitable. Initial trials with poultry manure seem promising