THE EFFECT OF CROPPING PATTERN ON THE PROFITABILITY OF LIQUID FERTILIZER USAGE IN DRY SEASON VEGETABLE PRODUCTION IN THE SOUTHERN GUINEA SAVANNAH

ZONE OF NIGERIA

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**Abstract:** Liquid fertilizers in dry season vegetable production are applied using different cropping patterns with little or no empirical evidence on which pattern is the most profitable. This study, therefore, investigated the effect of cropping patterns on the profitability of liquid fertilizer usage in dry season vegetable production. Specifically, the study identified the various vegetable enterprises, assessed the inputs and outputs of the different vegetable enterprises and estimated the profitability of the vegetable enterprises. A multi-stage random sampling procedure was used to select 309 farmers in the Southern Guinea Savannah zone. Pretested and structured interview schedules were used for data collection. Descriptive statistics and partial budgeting techniques were used for data analysis. Twelve different vegetable enterprises were identified in the study. Sixty percent of users of liquid fertilizer cultivated only fruit vegetables such as okra and peppers. The usage of the combination of both liquid and non-liquid fertilizers in mixed vegetable production yielded the highest quantity of output of about 1374kg/ha. However, usage of sole liquid fertilizer on exotic vegetables gave the highest profitability of 323 percent on the rate of return to capital investment. The study has concluded that the use of liquid fertilizer increases profitability and therefore recommends the formulation and implementation of policies that will encourage liquid fertilizer usage among the farmers.

**Key words:** liquid fertilizer, dry season, vegetable enterprise, profitability, fertilizing, crop production.

**Introduction**

The Southern Guinea Savannah zone is characterized by low rainfall and long dry periods which make it an excellent location for vegetable production. Dry season vegetable production is an important component of the farming systems in this zone. This is because it provides an opportunity for diet improvement and serves as a source of income and employment to the farmers. Vegetables are usually planted as sole crops or intercropped with staple crops like rice, maize or tubers (James et al., 2010). Farmers frequently intercrop vegetables on the same bed, so that a single bed can hold as many as five different vegetables (Ogunyinka et al., 2004). Intercropping is economically more profitable than sole cropping (James et al., 2010). This is because it increases the farmers’ income per unit of land and labor; helps maintain good soil structure, and the incidences of pests and diseases are reduced.

Fertilizers are needed in vegetable production due to the poor health conditions of the soils used for production in Nigeria. In the absence of the regular chemical fertilizers, farmers are left with no choice than to look for alternative means of fertilizing their soils. Commercial liquid fertilizer was first introduced into the country in 2003. Even though it had been around for over a decade, very little is known about it, especially with regards to its usage in dry season vegetable production. These liquid fertilizers act fast, and studies have shown that apart from an increase in output, crops grown with liquid fertilizer are more nutritious (Agbulu and Idu, 2008; Criollo et al., 2011). Its use has been associated with superior quality as well as the quantity of crops. There is also the advantage of improved efficiency in the application of liquid fertilizer. This is because it can be done alongside irrigation (drip or sprinkler) and pesticide application thereby saving time and resources (Finck, 1992; Dittmar, 2007).

Since vegetables are usually intercropped, an assessment of the cropping pattern of vegetable production on the profitability of liquid fertilizer usage will bring to limelight the interaction of the different cropping patterns, farm resources, and farm enterprises. This will enable the farmers to make the best decision as to what vegetables to grow, the quantity of inputs required as well as the output they stand to get.

In view of the foregoing, the study sought to: (i) identify the different vegetable enterprises in the study; (ii) assess the inputs and outputs of the different vegetable enterprises; and (iii) estimate the profitability of the vegetable enterprises in the study.

**Materials and Methods**

Study area, sampling technique, and sample size

This study was carried out in the Southern Guinea Savannah zone of Nigeria. The rainfall in this zone shows two peaks in July and September (Ogundare et al., 2012). Despite the fact that this is the most luxuriant of the savannah vegetation belts in Nigeria, the soils are low in organic matter and chemical fertility.

The population for the study comprised all dry season vegetable farmers in the study area. Locations, where dry season vegetable production was predominantly carried out, were identified from the 2012 Crop Area Yield Survey (CAYS) manual of the zone. Twenty-five percent of the identified locations in the zone were randomly selected. This gave a total of seventeen locations. Next, the different farmer groups in each of the selected locations were identified. A list of all dry season vegetable farmers was obtained from the leader of each of the groups. From those lists, another list was compiled to give the total number of vegetable farmers in that location irrespective of the group they belonged. From the compiled list, twenty-five percent of the listed vegetable farmers were randomly selected from each location to give a sample size of 317 vegetable farmers who were interviewed for the study. Data for only 309 farmers were eventually useful for analysis due to insufficient information given by the remaining eight.

Method of data collection

Data for the study were collected for the 2013/2014 dry season vegetable production using a well-structured interview schedule administered to vegetable farmers. Focus Group Discussion (FGD) was also organized with the local leaders of the vegetable farmer groups to supplement the data obtained from the interview schedule, and pretesting was done with 30 vegetable growers.

Analytical techniques

Descriptive statistics which include measures of central tendencies such as frequency distribution, mean, mode and percentages were used to identify the various vegetable enterprises encountered in the study, while the mean was used to assess the input and output of the different vegetable enterprises. The study also adopted the use of partial budgeting to calculate the profitability of liquid fertilizer usage for the vegetable enterprises. The gross margin (GM) was used specifically to estimate the costs and returns of the vegetable enterprises. GM analysis enables the comparison of the relative performances regarding returns of similar enterprises directly. Since GM is not a measure of farm profit per se because it does not include capital or fixed cost, profitability indices such as the operating ratio (OR) and return to capital invested (RCI) which can be calculated from the gross margin, and net profit was, therefore, employed in this study to show the profitability of the vegetable enterprises.

Mathematically,

GM = GVO – TVC (1)

GVO = P x Q (2)

Net profit = GM – TFC (3)

where,

GVO = Gross value of output;

TVC = Total variable cost;

P = Unit price of each vegetable; Q = Quantity of vegetable output, and

TFC = Total fixed cost.

TVC was then computed by summing up all the cost incurred for labor and purchased inputs for the production season while the TFC was computed by depreciating the fixed cost components. The straight line method of depreciation was used, and this is given as (4)

For this study, the salvage value was assumed to be zero because the vegetable farmers rarely sell off their equipment and machines. They use them until the value is completely or almost completely lost.

Profitability indices used were given as:

OR = TVC/GVO (5)

RCI = Net profit / Total cost (TC) (6) where TC = TFC + TVC.

GM is best calculated on a per hectare basis. This allows for easy projection/estimation of figures based on the actual land size intended for use in vegetable production. Consequently, the analysis was therefore done on a per plot basis. Thus, the 309 sampled farmers had a total of 448 plots.

**Results and Discussion**

The results obtained from the data analysis and the corresponding discussion are presented in this section.

Dry season vegetable production according to vegetable enterprises

The classes of vegetables cultivated by farmers and the different categories of fertilizers used in the study are presented in Table 1.

Table 1. Distribution of farms based on the category of fertilizer usage and class of vegetables.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Category of fertilizer usage/class of vegetables | Sole fruit vegetables | Sole leafy vegetables | Sole exotic vegetables | Mixed vegetables | Total |
| Liquid fertilizer only | 40 | 7 | 4 | 2 | 53 |
| Liquid with non-liquid fertilizer | 35 | 21 | 10 | 7 | 73 |
| Non-liquid fertilizer | 112 | 133 | 13 | 64 | 322 |
| Total | 187 | 161 | 27 | 73 | 448 |
|  | (41.70) | (35.90) | (6.10) | (16.30) | (100.00) |

Source: Field survey, 2015; \*Figures in parentheses are in percentages.

The vegetables encountered on the field during the survey were amaranthus, bitter leaf, celosia, corchorus, kenaf, pumpkin, scent leaf and waterleaf (classified as leafy vegetables). The fruit vegetables were garden egg, okra, onion, sweet pepper, hot pepper, long pepper, green pepper, and tomatoes. Others were cabbage, cucumber, lettuce, and carrots and these were classified as exotic vegetables.

Table 1 shows that the modal class of vegetables planted was the sole fruit, accounting for about 42 percent of total plots for dry season vegetable production. Almost 60 percent of plots where liquid fertilizer was used, either solely or with non-liquid fertilizers also had sole fruit vegetables planted on them. This was contrary to expectation. This was probably due to the fact that the information gathered during the pilot survey showed that liquid fertilizers were mainly used for leafy vegetables because it made the leaves of the vegetables very green. The reason for this unexpected trend may be because the vegetable farmers in the study area are fruit vegetable experts. It may also be because the returns for fruit vegetables are higher during the dry season than those for leafy vegetables. Profitability analysis will help to throw more light on the latter reason. It may also be because the liquid fertilizers simply work better with the fruit vegetables compared with the leafy vegetables. Liquid fertilizers were mostly used for okra, followed by garden egg, hot pepper, and sweet pepper among the fruit vegetables. Overall, the dominant leafy vegetables planted by the farmers were amaranthus and corchorus while it was okra and peppers generally for the fruit vegetables. Four different classes of vegetables were identified as well as three fertilizer categories, making a total of twelve (12) vegetable enterprises identified in the study. These are presented in Table 2.

Table 2. Distribution of farms according to vegetable enterprises.

|  |  |  |
| --- | --- | --- |
| Vegetable enterprise | Frequency | Percentage |
| Liquid only on sole fruit vegetables (E1) | 40 | 8.93 |
| Liquid only on sole leafy vegetables (E2) | 7 | 1.56 |
| Liquid only on sole exotic vegetables (E3) | 4 | 0.89 |
| Liquid only on mixed vegetables (E4) | 2 | 0.45 |
| Liquid with non-liquid on sole fruit vegetables (E5) | 35 | 7.81 |
| Liquid with non-liquid on sole leafy vegetables (E6) | 21 | 4.68 |
| Liquid with non-liquid on sole exotic vegetables (E7) | 10 | 2.23 |
| Liquid with non-liquid on mixed vegetables (E8) | 7 | 1.56 |
| Non-liquid only on sole fruit vegetables (E9) | 112 | 25.00 |
| Non-liquid only on sole leafy vegetables (E10) | 133 | 29.70 |
| Non-liquid only on sole exotic vegetables (E11) | 13 | 2.90 |
| Non-liquid only on mixed vegetables (E12) | 64 | 14.29 |
| Total | 448 | 100.00 |

Source: Field survey, 2015.

As shown in Table 2, plots, where non-liquid fertilizers were used on sole leafy vegetables (E10), were the modal class of vegetable enterprises.   
Plots where liquid fertilizer was used accounted for 28 percent of the total number of plots (E1 – E8).

Input-output analysis of the different vegetable enterprises

The physical quantities of liquid and non-liquid fertilizers used as well as other inputs used in vegetable production for the different enterprises are presented in this sub-section. These are presented in Table 3.

Table 3. Summary of physical inputs and outputs per hectare for the vegetable enterprises.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Variables | E1 | E2 | E3 | E4 | E5 | E6 | E7 | E8 | E9 | E10 | E11 | E12 | Total |
| No. of plots | 40 | 7 | 4 | 2 | 35 | 21 | 10 | 7 | 112 | 133 | 13 | 64 | 448 |
| Average farm size (ha) | 0.76 | 0.82 | 1.03 | 0.5 | 0.86 | 0.64 | 0.37 | 0.94 | 0.71 | 0.56 | 0.29 | 0.69 | 0.66 |
| Total farm size (ha) | 30.3 | 5.75 | 4.1 | 1.0 | 30.18 | 13.5 | 3.65 | 6.6 | 79.09 | 74.70 | 3.82 | 44.17 | 296.85 |
| Qty of output (kg) | 433.99 | 104.68 | 293.71 | 721.59 | 763.54 | 281.75 | 300.19 | 1374.21 | 438.06 | 176.73 | 174.33 | 253.53 | 350.52 |
| Qty of labor (man-day) | 126.15 | 162.51 | 161.72 | 296.63 | 198.84 | 208.17 | 130.48 | 235.24 | 286.65 | 482.44 | 188.87 | 359.7 | 320.21 |
| Qty of liquid fert. (litres) | 3.95 | 2.71 | 6.92 | 4.00 | 3.22 | 2.82 | 3.51 | 1.35 | 0 | 0 | 0 | 0 | 3.41 |
| Qty of non-liq.fert. (Kg) | 0 | 0 | 0 | 0 | 214.98 | 162.62 | 175.83 | 274.29 | 348.43 | 219.08 | 398.95 | 284.63 | 278.8 |
| Qty of seed (kg) | 0.10 | 0.07 | 0.01 | 0.15 | 0.17 | 0.11 | 0.02 | 0.05 | 0.20 | 0.51 | 0.03 | 0.28 | 0.27 |
| Qty of herbicide (litres) | 2.10 | 1.86 | 2.50 | 1.00 | 2.79 | 0.81 | 0.90 | 4.14 | 1.87 | 0.74 | 0.92 | 1.29 | 1.48 |
| Qty of pesticide (litres) | 3.44 | 1.78 | 8.17 | 3.00 | 5.91 | 3.08 | 8.33 | 7.48 | 7.10 | 4.31 | 9.65 | 5.71 | 5.48 |
| Qty of fuel for irrigation (litres) | 216.39 | 226.92 | 217.44 | 207.69 | 199.52 | 248.46 | 72.31 | 211.15 | 235.46 | 252.4 | 140.77 | 179.66 | 227.80 |
| Qty of water for irrigation (Hacm3) | 61.12 | 113.75 | 90.7 | 68.04 | 60.7 | 77.54 | 43.66 | 94.16 | 127.92 | 118.50 | 58.59 | 69.83 | 95.38 |

Source: Field survey, 2015.

Table 3 shows that users of sole liquid fertilizers on exotic vegetables (E3) had the largest average plot size, while users of sole non-liquid fertilizers on the same exotic vegetables (E11) had the smallest. Regarding total farm size, users of sole non-liquid fertilizers on fruit vegetables (E9) had the largest total farm size, while users of sole liquid fertilizers on mixed vegetables (E4) had the smallest. Users of both liquid and non-liquid fertilizers on mixed vegetables (E8) had the highest output, measured in grain equivalent, while users of sole liquid fertilizers on leafy vegetables (E2) had the least. This trend was, however, contrary to expectation.

The results on the quantity of labor used in dry season vegetable production show that users of sole non-liquid fertilizer on leafy vegetables (E10) used the highest quantity of labor and users of sole liquid fertilizers on fruit vegetables (E1) used the least. Users of sole liquid fertilizers on exotic vegetables (E3) used the highest quantity of liquid fertilizer, while users of both liquid fertilizers and non-liquid fertilizers on mixed vegetables (E8) used the least quantity. Similarly, users of sole non-liquid fertilizers on exotic vegetables (E11) used the highest quantity of non-liquid fertilizers while users of both liquid and non-liquid fertilizer on leafy vegetables (E6) used the smallest quantity. Analysis on the quantity of seed used in the study shows that users of sole liquid fertilizers on exotic vegetables (E3) used the least quantity of seeds while users of sole non-liquid fertilizers on leafy vegetables (E10) used the highest quantity. This may have been due to the very tiny nature of the seeds of the exotic vegetables which made them almost weightless. Also, most of the farmers planted an improved variety of the exotic vegetables and so did not need to sow more than the recommended seed rate because a hundred percent germination rate was almost guaranteed. The same could not be said for farmers who planted leafy vegetables. They used more of the local varieties and so had to sow more than the recommended seed rate to ensure a relatively high germination rate. The healthy looking vegetable plants are usually left on the field after germination, while the rest are weeded out.

On the average, users of both liquid and non-liquid fertilizers on mixed vegetables (E8) used the highest quantity of herbicides. This may have stemmed from their relatively larger plot sizes, and as such, use of herbicides especially during land preparation may have been cheaper. Users of sole non-liquid fertilizers on leafy vegetables (E10), on the other hand, used the least quantity of herbicides. Again, this may have stemmed from their relatively small plot sizes, so that clearing the weed with manual labor was more cost-effective, especially if the source of the labor was the family. In the same vein, users of sole liquid fertilizers on leafy vegetables (E2) used the least quantity of pesticides while users of sole non-liquid fertilizers on exotic vegetables (E11) used the highest quantity.

Users of sole non-liquid fertilizers on leafy vegetables (E10) used the highest quantity of fuel for irrigation while users of both liquid and non-liquid fertilizers on exotic vegetables (E7) used the least quantity. The same trend was noticed for the quantity of water used for irrigation. This may have been because more than half of the farmers in this group (E7) irrigated the land manually; hence, this could have contributed to the low usage of fuel and water for irrigation.

Profitability of liquid fertilizer usage in dry season vegetable production

This sub-section presents the results obtained from the profitability analysis of liquid fertilizer usage among the vegetable farmers in the study. These are presented in Table 4.

Table 4. Profitability analysis of the vegetable enterprises (₦/ha).

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Variables | E1 | E2 | E3 | E4 | E5 | E6 | E7 |
| Gross value of output (A) | 517,313 | 176,843 | 1,030,250 | 804,500 | 675,158 | 388,972 | 401,925 |
| Rent on land | 10,154 | 0 | 0 | 0 | 13,780 | 7,500 | 21,000 |
| Cost of hired labor& imputed family labor | 92,369 | 55,808 | 143,233 | 130,700 | 172,573 | 74,701 | 93,758 |
| Cost of liquid fertilizers | 9,164 | 6,614 | 14,833 | 11,000 | 8,372 | 4,718 | 7,919 |
| Cost of non-liquid fertilizers | 0 | 0 | 0 | 0 | 37,501 | 15,353 | 20,792 |
| Cost of seeds | 11,236 | 8,029 | 28,290 | 12,500 | 20,356 | 12,120 | 9,810 |
| Cost of herbicides | 3,513 | 2,257 | 7,767 | 2,000 | 3,891 | 2,222 | 2,883 |
| Cost of pesticides | 3,714 | 1,800 | 8,167 | 3,200 | 6,720 | 3,214 | 8,658 |
| Cost of fueling and maintenance of pumps | 33,355 | 19,857 | 28,092 | 24,000 | 23,162 | 24,590 | 10,817 |
| Total variable cost (B) | 163,505 | 94,365 | 230,382 | 183,400 | 286,355 | 144,418 | 175,637 |
| Total fixed cost (C) | 13,421 | 10,285 | 13,059 | 10,498 | 13,691 | 4,338 | 12,649 |
| Gross margin  (D = A-B) | 353,808 | 82,478 | 799,868 | 621,100 | 388,803 | 244,554 | 226,288 |
| Net profit  (E = D – C) | 340,387 | 72,193 | 786,809 | 610,602 | 375,112 | 240,216 | 213,639 |
| Operating ratio (B/A) | 0.32 | 0.53 | 0.22 | 0.22 | 0.42 | 0.37 | 0.44 |
| Return to investment (E/B+C) | 1.92 | 0.69 | 3.23 | 3.15 | 1.25 | 1.61 | 1.13 |

Table 4. Continued.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Variables | E8 | E9 | E10 | E11 | E12 | Total |
| Gross value of output (A) | 326,743 | 531,431 | 249,881 | 293,105 | 330,089 | 396,690 |
| Rent on land | 14,500 | 10,022 | 11,450 | 10,000 | 12,600 | 12,334 |
| Cost of hired labor& imputed family labor | 35,078 | 106,602 | 65,297 | 65,120 | 73,985 | 89,569 |
| Cost of liquid fertilizers | 3,369 | 0 | 0 | 0 | 0 | 8,866 |
| Cost of non-liquid fertilizers | 46,275 | 51,718 | 26,581 | 30,566 | 30,876 | 33,550 |
| Cost of seeds | 10,985 | 18,447 | 15,489 | 12,883 | 13,760 | 15,465 |
| Cost of herbicides | 4,228 | 3,590 | 1,218 | 4,467 | 2,179 | 2,666 |
| Cost of pesticides | 9,771 | 7,521 | 4,486 | 8,878 | 5,602 | 5,739 |
| Cost of fueling and maintenance of pumps | 23,086 | 22,558 | 21,267 | 30,566 | 30,876 | 24,352 |
| Total variable cost (B) | 147,742 | 220,458 | 145,770 | 162,480 | 169,878 | 192,541 |
| Total fixed cost (C) | 12,680 | 12,247 | 7,379 | 5,630 | 8,216 | 9,866 |
| Gross margin  (D = A-B) | 179,001 | 310,973 | 104,111 | 130,625 | 160,211 | 204,149 |
| Net profit  (E = D – C) | 166,321 | 298,726 | 96,732 | 124,995 | 151,995 | 194,283 |
| Operating ratio (B/A) | 0.45 | 0.41 | 0.58 | 0.55 | 0.49 | 0.49 |
| Return to investment (E/B+C) | 1.04 | 1.28 | 0.63 | 0.74 | 0.85 | 0.96 |

Table 4 confirms that dry season vegetable production was profitable for all the 12 enterprises. This agrees with the findings by Nwanchukwu and Onyenweaku (2007), Iwuchukwu and Uzoho (2009), Enete and Okon (2010), Ogunniyi (2011), Tsoho and Salau (2012) that dry season vegetable production is a profitable enterprise. Table 4 also shows that except for enterprise two (E2), users of liquid fertilizers either solely or with non-liquid fertilizers had higher net profit than users of non-liquid fertilizers when comparison is done based on the class of vegetables planted (i. e. compare E1 and E5 with E9; E3 and E7 with E11; and E4 and E8 with E12). Users of sole liquid fertilizers on exotic vegetables (E3) had the highest net profit. This was followed by users of sole liquid fertilizers on exotic vegetables (E4), then by users of both liquid fertilizers and non-liquid fertilizers on fruit vegetables (E5), and then by users of sole liquid fertilizers on fruit vegetable (E1). As earlier hypothesized, the result of cost and returns clearly shows that cultivation of fruit vegetables was more profitable than the cultivation of leafy vegetables. This is because, in all three fertilizer use categories, only the fruit vegetable class (E1, E5, E9) had higher net profit than the average recorded for the study which was calculated to be ₦194,283.

Enterprises E3, E4, and E1, in that order, had the highest rate of return to capital invested and the lowest operating ratio, while enterprises E10 and E11, in that order, had the lowest rate of return to capital invested and the highest operating ratio.

**Conclusion**

The study concluded that there were four different classes of vegetables and three different fertilizer usage categories, thus making a total of 12 vegetable enterprises identified in the study. Users of sole liquid fertilizers on leafy vegetables (E2) had the least cost of production, while users of sole liquid fertilizers on exotic vegetables (E3) had the highest gross margin and net profit, and consequently, the highest return to capital invested. Based on the findings, the study concludes that usage of liquid fertilizers whether solely or in combination with non-liquid fertilizers was more profitable for the dry season vegetable production. The study, therefore, recommended the use of sole liquid fertilizers for dry season vegetable production in the study area.

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Received: May 18, 2017

Accepted: August 24, 2018

UTICAJ SISTEMA GAJENJA NA PROFITABILNOST UPOTREBE TEČNOG ĐUBRIVA U POVRTARSKOH PROIZVODNJI TOKOM SUŠNE SEZONE U SAVANSKOJ ZONI JUŽNE GVINEJE U NIGERIJI

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R e z i m e

Tečna đubriva se u povrtarskoj proizvodnji tokom suve sezone primenjuju korišćenjem različitih plodosmena sa malo ili bez empirijskih dokaza o tome koji je oblik najprofitabiliji. Ovim se istraživanjem stoga ispituje uticaj plodosmene na profitabilnost upotrebe tečnog đubriva u povrtarskoj proizvodnji tokom suve sezone. Naime, u ovom istraživanju identifikovane su različite povrtarske prozvodne linije, ocenjena su ulaganja i prinosi različitih povrtarskoh proizvodnih linija i procenjena je profitabilnost povrtarskih proizvodnjih linija. Višestepena procedura slučajnog uzorkovanja korišćena je kako bi se izabralo 309 poljoprivrednih proizvođača u savanskoj zoni južne Gvineje. Pretestirani i strukturirani rasporedi intervjua korišćeni su za prikupljanje podataka. Deskriptivna statistika i tehnike delimičnog budžetiranja korišćene su za analizu podataka. Dvanaest različitih povrtarskih proizvodnih linija korišćene su u istraživanju. Šezdeset procenata korisnika tečnog đubriva uzgajalo je samo voćno povrće kao što su bamija i paprika. Upotreba kombinacije i tečnih i netečnih đubriva u mešovitoj povrtarskoj proizvodnji dala je najviši prinos od 1.374kg/ha. Međutim, najveća profitabilnost u visini od 323 procenata na stopu povraćaja na kapitalnu investiciju ostvarena je prilikom upotrebe isključivo tečnog đubriva u proizvodnji egzotičnog povrća. Ovim istraživanjem se zaključuje da upotreba tečnog đubriva povećava profitabilnost i stoga se preporučuje formulacija i sprovođenje politika koje će podsticati korišćenje tečnog đubriva od strane poljoprivrednih proizvođača.

**Ključne reči:** tečno đubrivo, suva sezona, povrtarska proizvodna linija, profitabilnost, đubrenje, ratarska proizvodnja.

Primljeno: 18. maja 2017.

Odobreno: 24. avgusta 2018.

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