Asian Journal of Plant Sciences

ISSN 1682-3974

science alert

ANSInet
an open access publisher
http://ansinet.com

OPEN ACCESS Asian Journal of Plant Sciences

ISSN 1682-3974
DOI: 10.3923/ajps.2022.606.612

Research Article
Prediction Model of Production Patterns of Shallot Development in Low and Medium Plains Regions, Indonesia

[1]Sri Ayu Andayani, [2]Amalia Nur Milla, [3]Tintin Febrianti, [4]Yayan Sumekar, [1]Ida Marina, [1]Dinar, [1]Dadan Ramdani Nugraha, [1]Kosasih Sumantri and [1]Sri Umyati

[1]Faculty of Agriculture, Universitas Majalengka, Indonesia
[2]Faculty of Agriculture, Universitas Muhammadiyah Sukabumi, Indonesia
[3]Faculty of Agriculture, Universitas Garut, Indonesia
[4]Faculty of Agriculture, Universitas Padjadjaran, Indonesia

Abstract

Background and Objective: Shallots have the potential to be developed but production is not optimal in terms of continuity and stability. Structuring production patterns should be a priority for farmers in onion farming. This study aims to map production patterns and create predictive models of production patterns in low and middle land areas to provide product stability. The method used in this study is a fuzzy logic approach based on ANFIS. **Materials and Methods:** The data used include time-series data, written information, input variables of production patterns, cropping pattern systems, production patterns, needs with shallot production development output variables. This research was conducted in Majalengka Regency in the low and middle lands. **Results:** The results showed that the prediction of the production pattern of the shallot cropping pattern was more focused on adjusting to the needs of use and consumption value, the low and middle land areas in the first quarter of consumption production were greater than seeds and in the third quarter these two regions were able to balance production for consumption and consumption needs, seeds. In the low-lying areas in the second quarter, the emphasis was on seed production of 70%, in the middle-land areas the emphasis was on 60% consumption of shallots, 20% industry and 20% seeds. **Conclusion:** Recommendations in the implementation of various strategies are expected through the establishment of a planting pattern information centre, the creation of new market opportunities, partnership patterns, expansion of planting areas.

Key words: Shallots, production pattern, fuzzy, ANFIS, lowland, medium, cropping pattern

Citation: Andayani, S.A., A.N. Milla, T. Febrianti, Y. Sumekar and I. Marina *et al.*, 2022. Prediction model of production patterns of shallot development in low and medium plains regions, Indonesia. Asian J. Plant Sci., 21: 606-612.

Corresponding Author: Yayan Sumekar, Faculty of Agriculture, Universitas Padjadjaran, Indonesia
Sri Ayu Andayani, Faculty of Agriculture, Universitas Majalengka, Indonesia

Competing Interest: The authors have declared that no competing interest exists.

Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

The horticultural commodity is one of the plants whose characteristics have uncertainty in production and price[1] and onion is one of them[2]. One of the factors causing yield uncertainty is climate change and this is one of the characteristics of agricultural commodities[3] so it will harm production[4]. One of the horticultural commodities that have the potential to be developed and has high economic value, namely onion is also one of the medicinal plant commodities in improving health[5]. Shallot cultivation is one of the livelihoods of farmers in rural areas but onion cultivation has not yet reached optimal productivity because it is attacked by many pests and diseases[6].

This shallot commodity is considered a strategic commodity[7] as well as an important crop in our country[8]. Needs onion as food supplement ingredients should be balanced with sufficient supply[9] and as one commodity into everyday cooking ingredient and can be used as efficacious herbal[10], red onions can also be produced as material drug production[11]. Shallots are also a commodity that has competitive and comparative advantages, productivity and sustain ability of competitiveness can be increased through the application of advanced technology, agricultural infrastructure and increasing the capacity of farmers' resources[12].

However, seeing the phenomenon, production has not been optimal while the demand and consumption of shallots are getting higher. Production and price fluctuations still occur for this commodity because demand continues to increase while production is still limited in certain months[13]. Shallots indicate a production risk commodity, although it is still at a low-level[14,15]. So that this commodity has production instability[16] and is susceptible to pests[17]. By looking at the phenomenon related to shallots, it is necessary to reorganize the production system in the dry season and rainy season so that the production of this commodity can be sustainable throughout the year in low and middle land areas. This study has the aim of how to map production patterns and identifying production patterns so that they can make predictive models of production patterns on the development of shallots in Majalengka Regency in low and middle land areas.

MATERIALS AND METHODS

Study area: The location of the research was carried out in Majalengka Regency, West Java in the low and middle land area, with the time of researching in January-March, 2021.

Methodology: This research was conducted with a quantitative descriptive method using a fuzzy logic approach. A fuzzy system is a system with a form based on rules in the form of a collection of IF-THEN rules. Fuzzy logic is used in decision making[18] and this method is considered a good alternative to linear models based on utility theory[19].

This fuzzy logic approach is carried out through three stages, including: (1) The stage of *fuzzification* is mapping from firm input to fuzzy sets, (2) The inference stage is the generation of fuzzy rules and (3) The affirmation stage (*Defuzzification*) is the transformation of the output from a fuzzy value to a firm value. The variables used in this study consisted of two input variables, namely (1) The production pattern with the cropping pattern system and (2) The production pattern with the use of shallot needs and one output variable, namely the development of shallots. The analysis of the assessment of each variable in this study was carried out using an approach fuzzy logic to quantify the obscurity. This is done with the consideration that the variable pattern of production with the cropping pattern system, the pattern of production with the use of shallot needs and horticultural development is vague and cannot be classified with certainty. So this fuzzy logic approach is considered to be able to classify each issue based on the level of importance according to the observations that have been made.

RESULTS AND DISCUSSION

Results of analysis of the development of shallots: The results of the study in the low and middle land areas can be seen in Fig. 1 from the results of the analysis of the ANFIS method with the Onion Price (OP) parameter, namely indicator (1), namely the price of RP 26,000, -, indicator (2) with the price of Rp. 16,000-25,000 and indicator three with the price IDR 5000-15.000, -, Total Population (TP) with four indicators, namely elderly people, five being children and six being adults. Consumption per Quarter (CQ) with indicator seven which is the first quarter, eight in the second quarter and nine in the third quarter. Use Needs (UN) shallots with indicators of ten, namely seeds or seedlings, eleven for industry and twelve for hotels, restaurants and catering as well as food stalls and households.

From the results of the analysis, it can be explained that the shallot price model is in the range of Rp. 26.000, - to produce seeds and stalls and is widely consumed by seniors who are cultivated in the first quarter of December to February, this series of models can be seen in the red line. The next model for Rp. 16.000-25.000,- with production for industrial purposes and mostly consumed by children in the

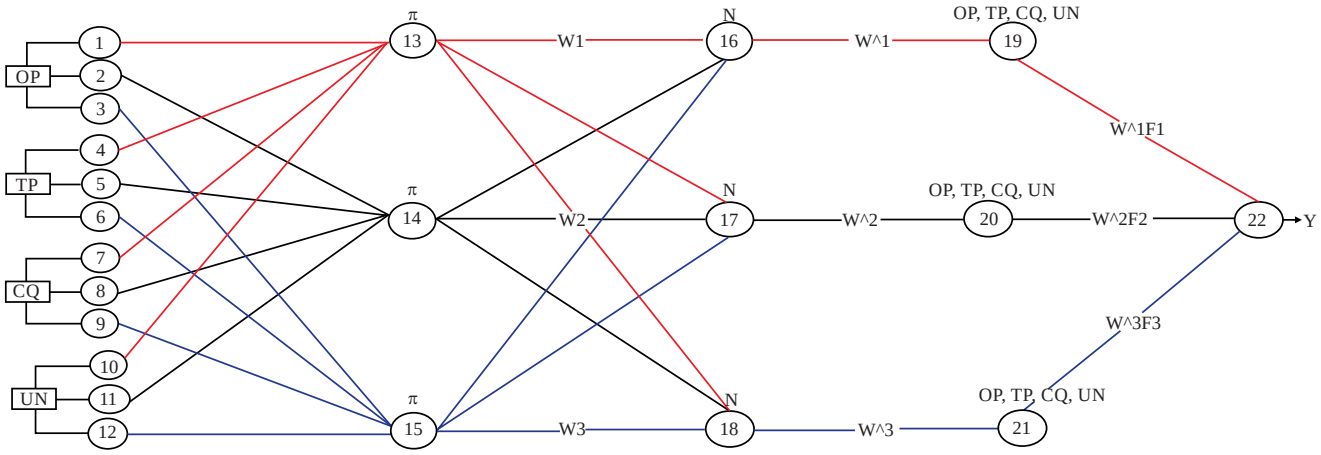

Fig. 1: Results of analysis of local needs shallots

Table 1: Results of calculation analysis related to the category of population in Majalengka regency who consume shallots

Total population			
Children (C)	Senior (S)	Mature (M)	Plain area
0.957762666	0.865033196	0.411857374	Medium
0.64	0.984615385	0.538901987	Low

Results of data calculation analysis, 2021

Table 2: Calculation results analysis of consumption of shallots seen from the quarter

Quarterly consumption (QC)			
I (T_1) (December-February)	II (T_2) (March-July)	III (T_3) (August-October)	Plain area
0.189713	0.094251	0.650289	Medium
0.289482	0.128866	0.948367	Low

Results of data calculation analysis, 2021, T: Treatment

second quarter, namely in March to June. This series of models can be seen on the black line, while the price model is Rp. 5000-15.000,- with the aim of hotels, restaurants, catering and households operating from August to October and mostly consumed by adults, this series of models can be seen in the blue line.

From the results of the calculation analysis using the ANFIS method, it was found that the price of shallots in the lowlands and middle lands were relatively not much different. This is because shallot production in all plain areas has the same relative price structure as a result of the character of the Majalengka Regency area in this case the quality, type and treatment of shallot cultivation. Seeing the phenomenon from the price aspect which is considered quite good, onion farmers in Majalengka Regency at this time must be able to create market opportunities other than the existing market.

It can be seen in Table 1 that the population in Majalengka Regency is divided into three categories, namely children, adults and seniors (elderly) who consume shallots. The results of the analysis showed that in all plain areas, namely 0.957 in the middle plains and 0.64 in the lowlands, the highest consumption of shallots was in the category of children and adults in the middle plains 0.87 and 0.98 in the lowlands. This shows that children and adults believe more in the benefits of red onions for health other than as a complementary seasoning or food flavouring. Seeing this condition, it is necessary to carry out educational activities or further understanding of the elderly on the benefits of shallots for health. Horticultural farming, especially shallots, needs to look at market conditions and consumption patterns, these conditions can affect the sustain ability of shallot production. This condition can also support the commercialization of farming[20].

In Table 2 it is explained that consumption in the first quarter is from December to February, the second quarter is March to June and the third quarter is August to October. The results of the analysis show that in the second quarter the level of consumption of shallots was low in all plains areas, namely around 0.09 and 0.12, while in the second quarter, consumption should be high due to the celebration

Table 3: Results of the analysis of the calculation of the use of requirements

Used needs of shallot (UN)			
Seeds	Industry	Hotel, restaurant, catering (Horeca) and/household	Plain area
0.590164	0.298408	0.961538	Medium
0.9	0.194763	0.671141	Low

Results of data calculation analysis, 2021

of Eid al-Fitr. Seeing this phenomenon, it can be assumed due to the condition of a pandemic COVID-19 also occur oversupply of onion from other regions, such conditions it is necessary onion farmers create market opportunities and strategies for other markets in the second quarter of this or it can also be more focus on seed production compared to consumption shallot production, this is also explained from the results of research[21] that planting shallots with seeds is better and more cost-effective as well as healthier seeds. The right strategy was also carried out in Malang in the development of shallots through the development of local production inputs through seed production[22]. In North Sumatra, the superior variety for shallot production is the Super Philip variety from wet and dry[23].

The results of the calculation analysis according to the use of needs shown in Table 3, show that the use of shallots for hotels, restaurants, catering, stalls and households is higher than the use of industrial needs and seeds by 0.96 in the middle plains. It can be assumed that the shallot planting area in Majalengka Regency is still considered low so that it does not meet the needs of the industry as well as productivity and quality that are not following industrial standards. However, farmers are still reluctant to cooperate with the industry is still due to pay quite a long delay on the part of the industry, whereas if you look at the United States Northeast part horticulture industry growth far exceeded the growth of plants and other commodities[24]. In India, it has also been identified that the horticultural industry is a means of diversification to make agriculture more profitable[25]. The shallot agroindustry will affect the availability of shallot in the market[26].

Prediction of shallot production pattern: By looking at the results of the analysis calculation, the prediction of the production pattern of the shallot commodity associated with: (1) The consumption value per quarter, namely the first quarter (December to February) and the third quarter (August to October) all plain areas can carry out shallot cultivation with the aim of harvest shallot consumption and shallot seeds. In the middle plains, shallot production should be smaller than in the lowlands, due to the lower consumption value, (2) The value of the use of shallots, namely the middle lands still has a low value for industrial use and seeds but for the lowland areas, seed production is already higher than in other areas (around 1.125%) although it is still in a low category for seed production. By looking at this condition, the pattern of production in the low and middle lands must change towards the achievement of harvesting for industrial and seed purposes, although when compared to Thailand, our country has not yet achieved optimal productivity[6].

Shallot commodity production pattern model: Aspects of the supply of shallots apart from the main ones in terms of the intended market value, namely the existence of (1) A location to carry out shallot cultivation, (2) A supportive climate in the implementation of shallot cultivation, (3) Supporting technology in carrying out shallot cultivation, (4) The price of production factors that will affect the implementation of shallot cultivation. Export destination onion is likely, although still in limited circumstances can lead the State of Singapore, Malaysia, Brunei Darussalam and should be able to guard against the import of onion that had been from China, Vietnam and the Philippines.

Implementation of onion cultivation in the lowlands and middle in the District Majelengka, in general, has become a habit of farmers and even a lot of culture passed down from family. This condition makes the experience of farmers in carrying out onion cultivation for a long time. This is one of the factors supporting success in farming, although it must be adjusted to current developments with supporting factors. The potential of land and climate also supports onion farming. However, many other factors can be considered as factors that must be optimized in the development of the shallot cluster in Majalengka. Conditions in the field are still a lot of pest and disease attacks, especially in the rainy season, the abundance of shallots during the main harvest, the supply of shallots from outside the region, the quality is still not optimal, especially for industrial markets, supporting institutions are not optimal, production and price fluctuations are still occurring.

Seeing the conditions in the field and the results of the calculation of the shallot research analysis, it is necessary to have several important points in the shallot production pattern, namely: (1) The production pattern by paying attention to the value of the consumption of shallots, (2) The production pattern by taking into account the value of the

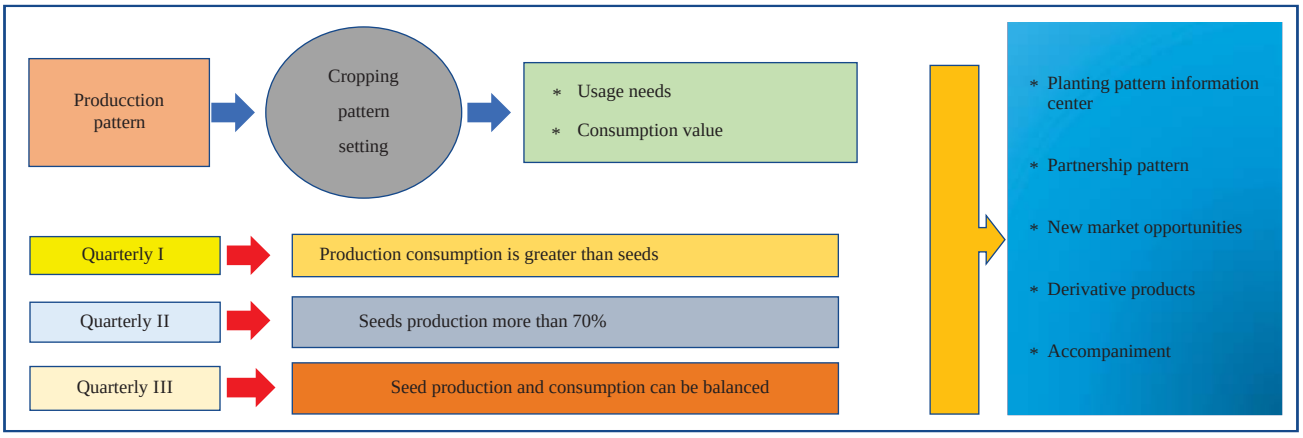

Fig. 2: Prediction model of shallot production patterns in the lowland

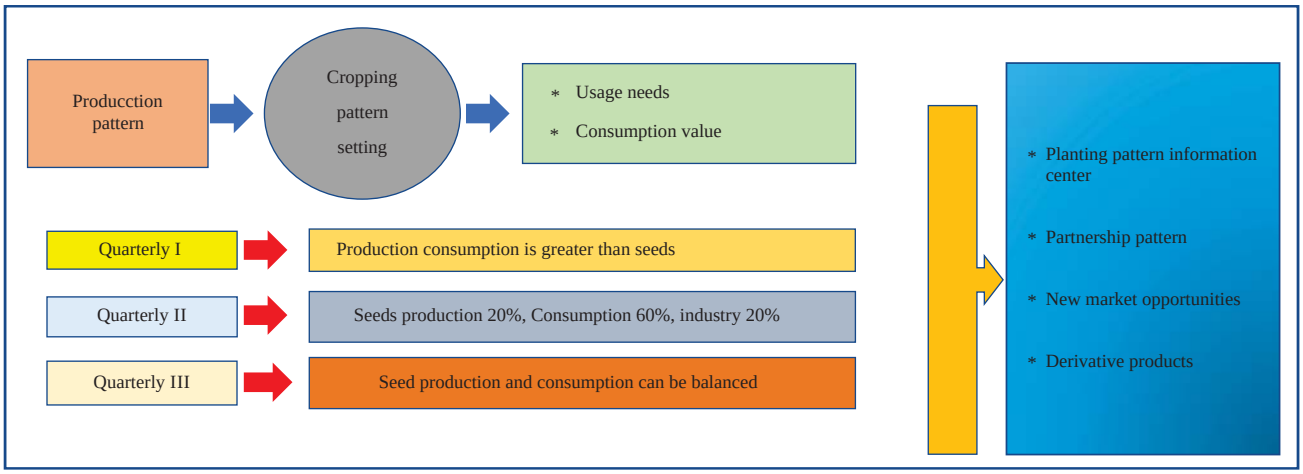

Fig. 3: Prediction model of shallot production patterns in the medium land

need and use of shallots, (3) Production pattern with partnership pattern. From these results, it can be assumed with several things such as the arrangement of cropping patterns with the creation and strategy of market opportunities, the existence of an integrated production and consumption data information centre to facilitate access for farmers in regulating cropping patterns, optimal supporting institutions in mentoring, coaching, education and training activities. application of more optimal shallot farming technology. Likewise, the results of research[27] that land evaluation need to be carried out to determine the potential land suitability class for shallots by using appropriate shallot varieties. It can be seen from the resulting model in supporting the development of shallot clusters in the Majalengka Regency, both in the lowlands and in the middle.

In Fig. 2, it can be seen that the predictive model of production patterns in the lowlands tends to carry out the production or cultivation of shallots with a time cropping pattern in the first quarter of December-February should produce more consumption shallots than shallots for seedlings. This is supported by the need for higher use and consumption of shallots. To meet the needs of the industry should also be considered considering that the first quarter of the industry also requires a lot of shallots as raw material for processing. The need for shallot seeds in the second quarter of March-June is greater than in other quarters, so the cropping pattern this month should focus more on seeds, while for the third quarter the cropping pattern is more balanced for seed production and consumption.

Based on the analysis and observations in the field, shallot farmers still rely on the experience and habits of growing shallots. However, despite this, shallot production has increased from year to year, although there are still fluctuations in production and prices. With this increase in production and to stabilize farmers' incomes, it is necessary to pay attention to production patterns and cropping patterns.

In Fig. 3, the prediction of the pattern of shallot production in the middle plains can be seen in the model.

In the middle plains, in general, the treatment of production patterns and cropping patterns is almost the same as in the lowlands, the only difference being that in the 2nd quarter, seed production is only 20% and consumption is more. For industrial purposes, it can also be taken into account that the industry needs this month are still in need. This research implies that farmers can more accurately predict planting needs so that a balance of supply and demand can be achieved. The recommended model for predicting production patterns in the low and middle land areas can be applied in the development of shallots. However, this study still has limitations in terms of the accuracy of cropping patterns in the event of climate anomalies, resulting in a shift in the planting period.

CONCLUSION

The results of the calculation analysis for the production pattern of shallots in the low and middle lands should pay attention to the production pattern and cropping pattern which is associated with the need for use and consumption value. The prediction model for the production pattern in the lowland areas in the second quarter emphasized more on seed production of 70% and the medium-land area more emphasis on consumption of shallots at 60, 20% for seeds and 20% for the industry. In the first quarter, these two regions were able to produce shallots for consumption greater than seed production and in the third quarter they were able to balance the need for consumption and seeds.

SIGNIFICANCE STATEMENT

This study found a map of shallot production patterns in the low and middle lands that must pay attention to production patterns and cropping patterns that are related to consumption values. This is beneficial for farmers to maintain production and price stability. This study will help researchers to uncover critical areas of shallot production pattern maps that cannot be explored by many researchers. Thus, a new theory on the map of shallot production patterns in the low and middle lands can be obtained.

REFERENCES

1. Hariyani, N., D. Koestiono and A.W. Muhaimin, 2017. The risk level of production and price of red chili farming in Kediri regency, East Java Province, Indonesia. Agric. Socio-Econ. J., 17: 81-87.
2. Andayani, S. Ayu, Suhaeni and Y. Sumekar, 2019. Distribution patterns and marketing efficiency of red onion in the highland of Majalengka regency. Int. J. Vet. Sci. Agric. Res., 1: 18-28.
3. Yilong, D., 2018. Article of the risk pricing mechanism of order agriculture supply chain. Manage. Eng. Brighton East J., 31: 61-67.
4. Mashizha, T.M., 2019. Adapting to climate change: Reflections of peasant farmers in mashonaland west province of Zimbabwe. Jàmbá J. Disaster Risk Stud., Vol. 11. 10.4102/jamba.v11i1.571.
5. Shahrajabian, M.H., W. Sun and Q. Cheng, 2020. Chinese onion, and shallot, originated in Asia, medicinal plants for healthy daily recipes. Notulae Sci. Biol., 12: 197-207.
6. Budi, W., M.A. Chozin, Dadang and E.I.K. Putri, 2014. Environmental efficiency analysis of shallot farming: A stochastic frontier translog regression approach. J. Biol. Agric. Healthcare, 4: 87-101.
7. Sutardi and H. Purwoninsih, 2018. Environment friendly cultivation of shallot on sandy land as specified location in Yogyakarta. J. Sumberdaya Hayati, 4: 1-6.
8. Fitriana N. and R. Susandarini, 2019. Short communication: Morphology and taxonomic relationships of shallot (*Allium cepa* L. group aggregatum) cultivars from Indonesia. Biodiversitas J. Biol. Diversity, 20: 2809-2814.
9. Muhammad, A., I. Wahyudi and D. Tangkesalu, 2019. Growth and yield of shallots planted between chili plants. Agroland Agric. Sci. J., 6: 63-70.
10. Ibnu, P.K., 2021. Affecting factors of shallots production level in Wanasari sub-district Brebes regency. Bus. Econ. Anal. J., 1: 27-37.
11. Hosseini, F.S., S.K. Falahati-pour, M.R. Hajizadeh, A. Khoshdel and M.R. Mirzaei *et al*., 2017. Persian shallot, *Allium hirtifolium* boiss, induced apoptosis in human hepatocellular carcinoma cells. Cytotechnology, 69: 551-563.
12. Saptana, E. Gunawan, A.D. Perwita, S.G. Sukmaya, V. Darwis, E. Ariningsih and Ashari, 2021. The competitiveness analysis of shallot in Indonesia: A policy analysis matrix. PLoS ONE, Vol. 16, 10.1371/journal.pone.0256832.
13. Andayani, S.A., S. Lies and P. Tomy, 2016. The development of red chili agribusiness cluster with soft system methodology approach in Garut. J. Mimbar, 32: 302-310.
14. Eugene, F., M. Suryanty and N.N. Arianti, 2019. Risk analysis of onion farming. J. Agric. Socio Econ. Bus., 1: 45-51.
15. Erny, D.H. Darwanto, Masyhuri, L.R. Waluyati, 2019. Farmer's behavior towards Lembah Palu shallot farm risks in Central Sulawesi, Indonesia. Eurasian J. Biosci., 13: 931-936.
16. Trisnasari, W., T. Perdana, Y. Deliana and Marimin, 2020. Situational analysis of shallot supply chain innovation system: A case study of Majalengka, West Java, Indonesia. Int. J. Supply Chain Manage., Vol. 9.

17. Berhanu, M.A. and G.A. Berhanu, 2014. Constraints of onion (*Allium cepa*. var aggregatum) in the case of Bibugn Woreda Amhara, regional state, Ethiopia. Food Sci. Qual. Manage., Vol. 32.
18. Rizaldi, D. Anggraeni, A.Z. Syah, A. Kholiq and R.T.A. Agus, 2021. Decision support system using fuzzy logic method of tahani model for student selection. J. Phys.: Conf. Ser., Vol. 1783. 10.1088/1742-6596/1783/1/012011.
19. Memmedova, K., 2017. Fuzzy logic modelling of the impact of using technology on anxiety and aggression levels of students. Procedia Computer Sci., 120: 495-501.
20. Mariyono, J., A. Kuntaringsih, H.A. Dewi, E. Latifah and P.B. Daroini *et al*., 2017. Pathway analysis of vegetable farming commercialization in Indonesia. Econ. J. Emerg. Mark., 9: 115-124.
21. Saidah, A.N. Wahyuni, Muchtar, I.S. Padang and Sutardi, 2020. The growth and yield performance of true shallot seed production in Central Sulawesi, Indonesia. Asian J. Agric., 4: 18-22.
22. Luta, D.A., 2021. Response of city's garbage compost on the production of several varieties of shallots. Budapest Int. Res. Critics Inst. (BIRCI-J.) Humanities, 4: 5105-5110.
23. Hindarti, S. and L.R. Maula, 2020. Shallot agribusiness development strategy in Purworejo village, Malang district. J. Sus. Dev. Sci., 2: 69-77.
24. Shields, M. and F.K. Willits, 2003. The growing importance of the environmental horticulture industry in the agricultural economy of the Northeastern united states. Agric. Resour. Econ. Rev., 32: 259-271.
25. Sengupta, U. and S.S. Roy, 2011. Behaviour of India's horticultural exports: Does price competitiveness play a determining role? Ind. J. Agri. Econ., 66: 231-241.
26. Astuti, L.C., J. Sutrisno, M. Harisudin and E.S. Rahayu, 2018. Analysis of fried shallot agroindustry to abundant production in Kuningan Regency. Acad. Res. Int., 9: 45-54.
27. Rahayu, R., M. Mujiyo and R.U. Arini, 2018. Land suitability evaluation of shallot (*Allium ascalonicum* L.) at production centres in Losari district, Brebes. J. Degraded Mining Lands Manage., 6: 1505-1511.