Resume

Dr ANIL KUMAR

Assistant Professor (Soil Science)

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RESUME

1. Name and Designation: Dr Anil Kumar
Assistant Professor (Soil Science)

2. Address of correspondence: O/o Deputy Director (Training)
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3. Date of Birth: 01-11-1983

4. Academic Qualification:

S.No.	Degree	University	Year	Grade (Class)
1	Ph.D. (Soil Sci.)	CSK Himachal Pradesh Agricultural University, Palampur (HP) - India	2012	First
2	M.Sc. (Soil Sci.)	CSK Himachal Pradesh Agricultural University, Palampur (HP) - India	2008	First
3	B. Sc. (Agriculture)	CSK Himachal Pradesh Agricultural University, Palampur (HP) – India	2006	First
4	Qualified Indian Council of Agricultural Research - National Eligibility Test (NET)			

5. Positions Held:

Designation	Duration		Institution
	From	To	
Assistant Professor (Soil Science)	24.03.2014	-Continue-	Krishi Vigyan Kendra, GADVASU, Booh, Tarn Taran (Punjab) - 143412.
Assistant Professor*	06.07.2012	29.07.2013	Guru Kashi Univrsity, Talwandi Sabo, Bathinda, India.
Senior Research Fellow**	09.08.2010	31.03.2012	Department of Soil Science, CSK HPKV, Palampur (HP)-176062.
Senior Research Fellow***	06.09.2008	14.01.2009	Department of Soil Science, CSK HPKV, Palampur (HP)-176062.

***** Joined as Assistant Professor before Ph.D. Thesis submission and continued even after Ph.D. completion.

****** Joined as SRF after completion of Course work and Comprehensive exams of Ph.D. programme as per Univ. Academic Council rules.

******* Joined as Senior Research Fellow after completion of M.Sc. Degree till joining in Ph.D. Programme in January, 2009.

6. Doctorate and Masteral Research

Ph.D. | **Soil Fertility & Chemistry** | **Phosphorus and rain-harvested water economy through Vesicular Arbuscular Mycorrhizae (VAM) in okra-pea sequence**

Objectives

- The impact of VAM on phosphorus and water-use-efficiency in okra-pea sequence
- To study changes in some important soil physico-chemical properties
- Impact of different treatments on soil P fractions
- To work out economics of different treatments

Salient findings

- The data on productivity, nutrient uptake, net returns and benefit cost ratio in okra-pea sequence indicated that treatment "VAM + 75 % soil test based recommended P dose at either of 2 irrigation regimes" did not differ significantly than the generalized recommended dose (NPK) and "VAM + 100 % soil test based recommended P dose", thereby suggesting an economy of about 25% in soil test based P dose through seed inoculation with mycorrhizal biofertilzer (VAM)
- The use of mycorrhizal biofertilizer (VAM) enhanced water-use-efficiency of okra and pea crops by about 5-17 and 12-35 %, respectively
- The VAM inoculation involving treatments did not alter available soil nutrient status significantly than non-VAM involving ones. However, available P status was enhanced by 15-20% after harvest each of the two crops i.e. okra and pea. Further, after completion of two years of okra-pea sequential cropping, treatments involving VAM inoculation enhanced water holding capacity and mean weight diameter of soil particles by 5-6 and 4-9 %, respectively than non-VAM inoculated ones
- The VAM involving treatments evaluated in okra-pea sequence for two years, led to higher status of water soluble-P, $NaHCO_3$-Pi, NaOH-Pi and low status of organic-P ($NaHCO_3$-P_o), each one of which contributed appreciably to available P supply to plants

M.Sc. **Soil Fertility & Chemistry** **Effect of Boron and FYM on off-season cauliflower (*Brassica oleracea* var. *botrytis*) under mid hill conditions of Himachal Pradesh**

Objectives

- To study the effect of boron fertilizers and FYM on cauliflower in terms of yield, quality, nutrient uptake and soil properties
- To compute efficiency of different boron fertilizers
- To work out economic dose of boron fertilizers and FYM for off-season cauliflower

Salient findings

- The application of FYM, boron and its sources increased marketable curd yield, quality and nutrient uptake
- The soil nutrients status improved due to FYM application. The boron and its sources increased available boron and phosphorus in soil. However, they did not exhibit any influence on soil available N and K
- The highest boron efficiency was recorded with 30 t ha^{-1} FYM applied in combination with granubor-II @ 0.5 Kg ha^{-1}
- The highest net returns were obtained due to granubor-II @ 1.5 kg ha^{-1} along with FYM applied @ 30 t ha^{-1}. However, the maximum B:C ratio was recorded with 20 t ha^{-1} FYM and 1.5 kg ha^{-1} of B applied as granubor-II

Additional Qualification

- Two years NCC with "BEE" certificate (July 2002 to July 2004)
- One year NSS (August 2004 to August 2005)
- Working knowledge of MS Word, Excel, Power Point and Internet (3 month course).

7. Awards and honours received:

- **Excellence in Extension Award – 2018** by Astha Foundation, Meerut.
- **Young Scientist Award– 2018** by Society of Krishi Vigyan, Sonarpur, Kolkata.
- *Jagar Nath Raina Memorial* **All India Best Publication Award – 2017** by Society for Advancement of Human and Nature, Solan, HP.
- **National Award** (3rd position) to Krishi Vigyan Kendra, Tarn Taran for Swachhta under Swachh Bharat Mission **-- 2017** by Indian Council of Agricultural Research (ICAR), New Delhi.
- **Appreciation letter from Vice Chancellor**, Guru Kashi University, Bathinda, Punjab for excellent work done during Scholarship Test 2013 held at University.
- **3rd best Award** in Pashu Palan Mela (March, 2017) to Krishi Vigyan Kendra, Tarn Taran for team work for best display and technology transfer to farmers
- **2nd best Award** in Pashu Palan Mela (September, 2017) to Krishi Vigyan Kendra, Tarn Taran for team work for best display and technology transfer to farmers
- Conferred with **Commendation certificate** for presentation of Ph.D. Thesis in contest for ISSS Best Doctoral Research Presentation Award held at CAZRI, Jodhpur
- **Merit scholarship** in M.Sc. (Soil Science)
- **Merit scholarship** in Ph.D. (Soil Science)
- Served as **Joint Secretary** for one year (2009-10) of Indian Society of Soil Science- Palampur Chapter

8. Membership of Professional Societies:

- **Life Member** - Indian Society of Soil Salinity and Water Quality, CSSRI, Karnal - India
- **Life Member** - Society of Agricultural Professionals, CSAUAT, Kanpur - India
- **Life Member** - Society for advancement of Humans and Nature, YSPUHF, Solan - India
- **Life Member** - Society of Krishi Vigyan, RMVU, Arapanch Sonarpur, Kolkata - India
- **Life Member** - Vigyanik Pashu Palan, GADVASU, Ludhiana, Punjab – India

9. Details of publications:

Research/Review Papers Published

	Details of Publications	NAAS Rating (2018)
1.	**Kumar, A**., Choudhary, A.K. and Suri, V.K. 2017 Agronomic bio–fortification and quality enhancement in okra–pea cropping system through arbuscular mycorrhizal fungi at varying phosphorus and irrigation regimes in Himalayan acid Alfisol. *Journal of Plant Nutrition* DOI:10.1080/01904167.2016.1267208.	**6.62**
2.	**Kumar, A**., Choudhary, A.K and Suri, V.K. 2016. Influence of AM fungi, inorganic phosphorus and irrigation regimes on plant water relations and soil physical properties in okra (Abelmoschus esculentus l.) – pea (Pisum sativum l.) cropping system in Himalayan acid Alfisol. *Journal of Plant Nutrition* 39 (05):666-682. DOI:10.1080/01904167.2015.1087030.	**6.62**
3.	**Kumar, A.,** Choudhary, A.K., Suri, V.K. and Rana, K.S. 2016. AM fungi lead to fertilizer phosphorus economy and enhanced system productivity and profitability in okra (Abelmoschus esculentus) – pea (Pisum sativum) cropping system in Himalayan acid Alfisol. *Journal of Plant Nutrition* 39(10): 1380-1390. DOI: 10.1080/01904167.2015.1143499.	**6.62**
4.	**Kumar, A.,** Suri, V.K., Choudhary, A.K., Yadav, A., Kapoor, R., Sandal, S. and Dass, A. 2015. Growth behavior, nutrient harvest index and soil fertility in okra–pea cropping system as influenced by AM fungi, applied phosphorus and irrigation regimes in Himalayan acid Alfisol. *Communications in Soil Science and Plant Analysis* 46 (17): 2212-2233. [DOI: 10.1080/00103624.2015.1069323].	**6.59**
5.	**Kumar, A.,** Suri, V.K., and Choudhary, A.K. 2014. Influence of inorganic phosphorus, VAM fungi, and irrigation regimes on crop productivity and phosphorus transformations in okra (Abelmoschus esculentus L.)–pea (Pisum sativum L.) cropping system in an Acid Alfisol. *Communications in Soil Science and Plant Analysis* 45 (7): 953-967. [DOI:10.1080/00103624.2013.874025].	**6.59**
6.	**Kumar, A.,** Choudhary, A.K. and Suri, V.K. 2015. Influence of AM–fungi and applied phosphorus on growth indices, production efficiency, phosphorus–use efficiency and fruit–succulence in okra (Abelmoschus esculentus)–pea (Pisum sativum) cropping system in an acid Alfisol. *Indian Journal of Agricultural Sciences* 85 (8): 1030-1037.	**6.22**
7.	**Kumar, A.,** Choudhary, A.K. and Suri, V.K. 2016. Influence of AM fungi and inorganic phosphorus on fruit characteristics, root morphology, mycorrhizal colonization and soil phosphorus in okra–pea production system in Himalayan acid Alfisol. *Indian Journal of Horticulture* 73(2): 213-218. DOI: 10.5958/0974-0112.2016.00050.5.	**6.15**

8. Yadav, A., Suri, V.K., **Kumar, A** and Choudhary, A.K. 2017. Effect of AM fungi and phosphorus fertilization on P-use efficiency, nutrient acquisition and root morphology in pea (*Pisum sativum* L.) in an acid Alfisol. *Journal of Plant Nutrition* 41 (6): 689-701. DOI:10.1080/01904167.2017.1406107]. **6.62**

9. Bai, B., Suri, V.K., **Kumar, A.** and Choudhary, A.K. 2016c. Tripartite symbiosis of Pisum–Glomus–Rhizobium lead to enhanced productivity, nitrogen and phosphorus economy, quality and biofortification in garden pea in a Himalayan acid Alfisol. *Journal of Plant Nutrition* 39: 666-682. **6.62**

10. Bai, B., Suri, V.K., **Kumar, A**. and Choudhary, A.K. 2016a. Influence of dual–inoculation of AM fungi and Rhizobium on growth indices, production economics and nutrient use efficiencies in garden pea (Pisum sativum L.*). Communications in Soil Science and Plant Analysis* 47: 941-954. **6.59**

11. Bai, B., Suri, V.K., **Kumar, A.** and Choudhary, A.K. 2016b. Influence of Glomus–Rhizobium symbiosis on productivity, root morphology and soil fertility in garden pea in Himalayan acid Alfisol. *Communications in Soil Science and Plant Analysis* 47: 787-798. **6.59**

12. Suri, V.K., Choudhary, A.K. and **Kumar, A.** 2013. VAM fungi spore populations in different farming situations and their effect on productivity and nutrient dynamics in maize and soybean in Himalayan acid Alfisol. *Communications in Soil Science and Plant Analysis*. 44 (22): 3327-3339, [DOI: 10.1080/ 00103624. 2013.848283] **6.59**

13. Yadav, A., Suri, V.K., **Kumar, A.** Choudhary, A.K. and Meena, A.L. 2015. Enhancing plant water relations, quality and productivity of pea (Pisum sativum L.) through AM fungi, inorganic phosphorus and irrigation regimes in a Himalayan acid Alfisol. *Communications in Soil Science and Plant Analysis* 46 (1): 80-93. [DOI:10.1080/00103624.2014.956888]. **6.59**

14. Basu, PS., Singh U., **Kumar A.**, Praharaj CS and Shivran RK. 2016. Climate change and its mitigation strategies in pulses production. *Indian Journal of Agronomy* 61: 71-82 **5.46**

15. Yadav, A., Suri, V.K., **Kumar, A.** and Choudhary, A.K. 2015. Influence of AM fungi and inorganic phosphorus on growth, green pod yield and profitability of pea (Pisum sativum L.) in Himalayan acid Alfisol. *Indian Journal of Agronomy* 60 (1): 163-167. **5.46**

16. **Kumar A,** Prakash B, Brar NS and Kumar B. 2018. Potential of vermicompost for sustainable crop production and soil health improvement in different cropping systems. International Journal of Microbiology and Applied Sciences 7(10): 1042-1055. **5.38**

17. Brar NS, **Kumar A** and Kumar B. 2017. Performance of summer mungbean (Vigna radiata L.) under different sowing time at farmers' field. *International Journal of Current Microbiology and Applied Sciences* 6 (8): 2211-2219. **5.38**

18. **Kumar A**, Parmar DK and Kiran. 2013. Response of off-season cauliflower (Brassica oleracea var. botrytis) to boron and organic manure nutrition under mid hill conditions of Himachal Pradesh (Short Communication). *Journal of the Indian* **5.23**

Society of Soil Science 61(2): 158-160.

19. Kapoor R, Sandal SK, Sharma SK, **Kumar A** and Saroch K. 2014. Effect of varying drip irrigation levels and NPK fertigation on soil water dynamics, productivity and water use efficiency of cauliflower in wet temperate zone of Himachal Pradesh. *Indian Journal of Soil Conservation* 42 (3): 249-254. **5.20**

20. Brar NS, Kumar B, Singh P, **Kumar A** and Singh P. 2017. Qualitative assessment of silage prepared at farmers' field in Tarn Taran district of Punjab. *Indian Journal of Animal Nutrition* 34 (3): 357-360. **5.02**

21. **Kumar A**, Brar NS, Pal S and Singh P. 2017. Available soil macro and micro-nutrients under rice wheat cropping system in District Tarn Taran of Punjab. *Ecology, Environment and Conservation* 23 (1): 229-234. **4.89**

22. Suri VK, **Kumar A** and Choudhary AK. 2017. AM-fungi lead to better plant nutrient acquisition and drought tolerance in agricultural crops: A review. *Current Advances in Agricultural Sciences- An International Journal* 9 (1): 1-12 **4.69**

23. Choudhary AK, Pooniya V, Bana RS, **Kumar A** and Singh U. 2014. Mitigating pulse productivity constraints through phosphorus fertililization- A review. *Agricultural Review* 35(4): 314-319. **4.37**

24. Suri VK and **Kumar Anil**. 2013. Role of vesicular arbuscular mycorrhizae (VAM) in meeting phosphors needs of important crops and cropping systems. *Progressive Agriculture- An International Journal* 13(1): 67-72. **4.29**

25. Suri, VK, **Kumar Anil** and Choudhary AK. 2012. Soil Health Management through Carbon Sequestration under Changing Climatic Scenario. Lead paper ICLDBT International Symposium published during Sept., 2012 in *Progressive Agriculture-An International Journal*. 11 (Conf. issue): 29-42. **4.29**

26. Sandal SK, Saini K, **Kumar Anil**, Kumar N and Sharma SK. 2012. Effect of fertilizer recommendations and tillage manipulation on productivity and nutrient uptake of rainfed wheat (Triticum aestivum) in an Alfisol. *Agropedology* 22(2): 11-11. **4.16**

27. Brar NS, Kumar B, **Kumar A**, Singh P and Pal S. 2016. Performance of different cultivars of Kharif fodder maize under late sown conditions of Punjab. *International Journal of Farm Sciences* 6 (4): 1-6. **4.01**

28. Prakash B, Khairnar SO, Mandal A, **Kumar A** and Kumar B. 2018. Composite fish farming: A review on economic enterprise for rural empowerment and livelihood generation. *International Journal of Fisheries and Aquatic Studies* 6(4): 545-550. **3.99**

29. Brar NS, Singh P, **Kumar A**, Kumar B and Pal S. 2016. Maize silage feeding vis-a-vis milk production in cross bred dairy cows in Tarn Taran district of Punjab. *Progressive Research* 11: 269-70. **3.84**

30. **Kumar A.** and Parmar DK. 2014. Influence of boron and organic manure nutrition on productivity, nutrient uptake and soil properties in autumn cauliflower under western Himalayas conditions. *International Journal of Tropical Agriculture* 32 (3- **3.49**

4): 695-705.

31. **Kumar A**, Parmar DK and Suri VK. 2011. Effect of boron fertilizers and organic manure on autumn cauliflower in Western Himalayas. *Annals of Horticulture* 5 (1): 17-24. **3.42**

32. **Kumar Anil**, Suri VK, Sandal S, Saroch K and Yadav A. 2012. Phosphorus transformation in an acid soil of Western Himalayas as influenced by its application along with VAM in okra-pea sequence. In: *8th International Conference on Plant and Soil Interaction at Low pH* held at UAS, Banglore 18-22 Oct 2012 p. 278-279. --

33. Pierre MJ, Bhople BS, **Kumar Anil**, Erneste H, Emmanuel B and Singh YN. 2014. Contribution of Arbuscular Mycorrhizal Fungi (AM Fungi) and Rhizobium Inoculation on Crop Growth and Chemical Properties of Rhizospheric Soils in High Plants. *IOSR Journal of Agriculture and Veterinary Science* 7: 45-55. -

34. Bhople BS, Adhikari K, **Kumar Anil**, Singh A and Singh G. 2014. Sub-Surface Method of Irrigation- Clay Pipe Irrigation System. *IOSR Journal of Agriculture and Veterinary Science* 7: 60-62. --

Book Chapters Published:

1) **Kumar A** and Choudhary AK. 2018. AM Fungi: A Potential Myco-Biofertilizer for Nutrient and Water Acquisition in Rainfed and Dryland Ecologies. *In*: Climate resilient agro-technologies for enhanced crop and water productivity under water-deficit agro-ecologies' (ISBN 978-93-83168-31-6) (Rana KS *et al.*), ICAR-Indian Agricultural Research Institute, New Delhi. pp 99-111.

2) **Kumar, A.,** Choudhary, A.K., Pooniya, V., Suri, V.K. and Singh, U. 2016 (***Springer***). Soil Factors Associated with Micronutrient Acquisition in Crops- Biofortification Perspective. Biofortification of Food Crops by Singh et al., pp 159-176. ISBN: 978-81-322-2714-4 (Print) 978-81-322-2716-8 (Online) DOI 10.1007/978-81-322-2716-8_13. URL: http://link.springer.com/book/10.1007/978-81-322-2716-8.

3) **Kumar A** and Anil K. Choudhary. 2014. Scientific Cultivation of Vegetable Pea (Pisum sativum L.). pp 45-54. In: Choudhary, A.K., Rana, K.S., Dass, A., Srivastav, M. (Eds.). Advances in Vegetable Agronomy. [ISBN: 978-93-83168-17-0]. Post Graduate School, IARI, New Delhi & ICAR, New Delhi, India. 358 p.

4) **Kumar A** and Bhople BS. 2015. Effective moisture conservation practices for mitigating soil water stress under changing climate. In: In: Environmental Science and Engineering (vol 12) *Climate Change and Sustainable Technology*, pp 91-105.

5) **Kumar A**, *Anil K. Choudhary and S. Rahi. 2014.* Scientific Cultivation of Broccoli (*Brassica oleracea* L. *var. italica*) pp 87-91. In: Choudhary, A.K., Rana, K.S., Dass, A., Srivastav, M. (Eds.). Advances in Vegetable Agronomy. [ISBN: 978-93-83168-17-0]. Post Graduate School, IARI, New Delhi & ICAR, New Delhi, India. 358 p.

6) **Kumar A**, *Anil K. Choudhary and S. Rahi. 2014.* Scientific Cultivation of Brussels sprouts (*Brassica oleracea* L. *var. gemmifera*) pp 92-95. In: Choudhary, A.K., Rana, K.S., Dass, A., Srivastav, M. (Eds.). Advances in Vegetable Agronomy. [ISBN: 978-93-83168-17-0]. Post Graduate School, IARI, New Delhi & ICAR, New Delhi, India. 358 p.

7) **Kumar A**, *Anil K. Choudhary and S. Rahi. 2014.* Scientific Cultivation of Knol-Khol (*Brassica oleracea* L. *var. gongylodes*) pp 96-99. In: Choudhary, A.K., Rana, K.S., Dass, A., Srivastav, M. (Eds.). Advances in Vegetable Agronomy. [ISBN: 978-93-83168-17-0]. Post Graduate School, IARI, New Delhi & ICAR, New Delhi, India. 358 p.

8) **Kumar A** *and Anil K. Choudhary. 2014.* Scientific cultivation of Okra (*Abelmoschus esculentus* L.) pp 255-259. In: Choudhary, A.K., Rana, K.S., Dass, A., Srivastav, M. (Eds.). Advances in Vegetable Agronomy. [ISBN: 978-93-83168-17-0]. Post Graduate School, IARI, New Delhi & ICAR, New Delhi, India. 358 p.

9) **Kumar A**, Anil K. Choudhary, VK Suri, RS Bana, Vijay Pooniya and Ummed Singh. 2014. Site specific Water Management for Sustainable Agriculture pp 327-336. In: M.S. Meena, K.M. Singh and B.P. Bhatt (Eds.). Water Management in Agriculture.

10) **Kumar** A and Sharma M. 2016. Tie-up with foreign agricultural institutes for higher education. In: *ICAR sponsored Winter School on Innovations in Educational Technology*, December 01 – 21, 2016, RCA, MPUAT, Udaipur, India, pp. 47-52.

11) Suri VK and **Kumar A.** 2011. Potential of Integrated Nutrient Supply and Soil Health Improvement in Sustainable Cropping Systems of Indian Himalayas. In: *Sustainable Hill Agriculture: An overview* (Anil Kumar *et al*. eds.), Agrobios (India), pp. 123-149.

12) Suri VK and **Kumar A**. 2011. Managing Water Resources for Food Security in Changing Scenario. In: *Climate change and food security in India* (Tripathi AK and Pathak H. eds), The Society of Agricultural Professionals, CSAUAT, Kanpur, India, pp. 112-126.

13) Suri VK, Sidhu GS and **Kumar A**. 2013. Physical attributes: Soil and landscape characteristics of western Himalayan region of India *In:* Climate Change and its Ecological Implications for the Western Himalaya (Ed. Chopra VL), Scientific Publishers, Jodhpur, ISBN No. 978-81-72338-09-1, pp 1-48.

14) Suri VK, **Kumar A** and Choudhary 2017. Arbuscular Mycorrhizal Fungi: An Eco-Friendly Bio-Resource for Enhancing Nutrient Use Efficiency and Drought Tolerance in Agricultural Crops. *In:* Mycorrhizal Fungi (Aggarwal and Yadav Eds.), Astral International Pvt. Ltd., New Delhi, pp. 291-309.

15) Sharma M and **Kumar A**. 2016. Use of Photography in developing visual aids for effective communication. In: *ICAR sponsored Winter School on Innovations in Educational Technology*, December 01 – 21, 2016, RCA, MPUAT, Udaipur, India, pp. 41-46.

16) Choudhary AK, Pooniya V, Rahi S and **Kumar A**. 2014. Agronomic Practices of Vegetable Crops. In: Natural Resource Management for Sustainable Agriculture (Ed. Rana et al), Venus Publishers, New Delhi, ISBN No. 978-93-83168-06-4, pp 29-35.

17) Sandal SK, Sepehya S and **Kumar Anil**. 2010. Efficient water management techniques under poly house conditions. In: *Summer School on Protected Cultivation for Enhanced Profitability* (Sept 3-23, 2010) Deptt of Vegetable Sciences and Floriculture, CSK HPKV Palampur, pp. 43-48.

18) Choudhary AK, Pooniya V, Bana RS and **Kumar A**. 2014. Efficient Utilization of Organic Wastes and their Impact on Soil Health. In: Natural Resource Management for Sustainable Agriculture (Ed. Rana et al), Venus Publishers, ISBN No. 978-93-83168-06-4, pp 198-202.

19) Choudhary AK, Rahi S and **Kumar A**. 2014. Integrated Nutrient Management in Vegetable Crops. In: Advances in Field Crop Production (Ed. Rana et al), Venus Publishers, ISBN No. 978-93-83168-08-8, pp 29-35.

20) *Savita, Jaipaul, Anil K. Choudhary and Mahendra Singh Negi and* **Kumar A**. *2014.* Scientific Cultivation of Cauliflower (*Brassica oleracea* L. var. *botrytis*) pp 67-78. In: Choudhary, A.K., Rana, K.S., Dass, A., Srivastav, M. (Eds.). Advances in Vegetable Agronomy. [ISBN: 978-93-83168-17-0]. Post Graduate School, IARI, New Delhi & ICAR, New Delhi, India. 358 p.

21) *Savita, Jaipaul, Anil K. Choudhary, Mahendra Singh Negi and* **Kumar A**. *2014.* Scientific Cultivation of Cabbage (*Brassica oleracea* L. var. *capitata*) pp 79-86. In: Choudhary, A.K., Rana, K.S., Dass, A., Srivastav, M. (Eds.). Advances in Vegetable Agronomy. [ISBN: 978-93-83168-17-0]. Post Graduate School, IARI, New Delhi & ICAR, New Delhi, India. 358 p.

22) Havugimana E, Bhople BS, **Kumar A,** Byiringiro E, Mugabo JP and Kumar A. 2015. Soil pollution - Major sources and types of soil pollutants. In: Environmental Science and Engineering (vol 11): *Soil Pollution and Phytoremediation, pp 53-86.*

23) Anil K. Choudhary, V.K. Suri and **Kumar A**. 2014. Soil and Fertilizer Management in Horticultural Crops. pp 175-185. In: Srivastav, M., Choudhary, A.K., Rana, K.S., Dass, A. (Eds.). Agronomy of Horticultural Crops [ISBN: 978-93-83168-19-4]. Post Graduate School, IARI, New Delhi & ICAR, New Delhi, India. 210p.

24) Choudhary AK, Ranjana GA and **Kumar A.** 2018. Soil fertility management under ICM. *In*: Integrated Crop Management Practices for Enhancing Productivity, Resource-Use Efficiency, Soil Health and Livelihood Security (ISBN 978-93- 83168-32-3) (Eds. Choudhary AK *et al.*), ICAR–Indian Agricultural Research Institute, New Delhi. pp 33-39.

Extension/popular Articles Published

1) **Kumar A.** 2018. Khadan di santulit varton lai jaruri hai Mitti Parakh. *Krishi Jagran* 20(2): 42-44.

2) **Kumar A**, Kumar B, Singh N and Singh N. 2017. Jeevanu khadon ka mrida aivam jal sarankshan me mehtab. *Kheti Duniya* 22.4.2017, pp.2.

3) **Kumar A**, Kumar B and Pal S. 2017. Mrida Sukhsham jeevon ki mehtabta ko jane. *Kheti Duniya* 1(8): 4.

4) **Kumar A** and Kumar B. 2017. Hari khad ugayein, mrida urbarta badhayein. *Modern Kheti* 15 (8): 42.

5) **Kumar A**, Nisha, Choudhary AK and Suri VK. 2017. Impact of global warming on soil microbial community. *Indian Farming* 67 (4): 9-10.

6) **Kumar A**. 2014. Mrida Jaanch Karwayen Unnat Kheti Ki Taraf kadam bhadhayen. *Kheti dunia* (13.12.2014), 19(50): 7.

7) **Kumar A**, Nisha, Suri VK and P.Singh. Kenhua khaad: ek upyogi vikalp. *Kheti dunia* (22.11.2014), 19(47): 3.

8) **Kumar A**, Singh N and Singh P. 2015. Mitti Parakh: Unnat kheti vale k kadam. *Kheti dunia* (04.07. 2015), 33(27): 10.

9) **Kumar A** and Kumar B. 2017. Pashuyan de gohe di bnauo gandoya khaad ta jo bhoomi di sehat rhe barkrar. *Vigiyanak Pashu Palan* **11**(2): 18-20

10) **Kumar A**, Pal S and Kumar B. 2017. Vermicompost: A promising input for agricultural and horticultural crop. Livestock Technology 3(7): 60-61.

11) **Kumar A** and Kumar B. 2017. Swasth mrida aivam tikayu kheti ka aadhar kenchua khad. Modern Kheti.

12) **Kumar A,** Suri VK. 2010. VAM jeevanu khad ka upyog karke yun badhayen aay. *Kheti Duniya* (15.05.2010). 20: 7.

13) **Kumar A,** Suri VK, Dutta J, Sepehya S, and Sandal S. 2012. Mrida urbarta badhane ke liye Karen zaibik khadon ka upyog. *Kisan ki Awaaz***,** *National Magazine of Farmers' Voice* 3(2): 12-13.

14) **Kumar A** and Dutta Jintu. 2012. Water management in hills and cold deserts regions of Western Himalayas. *Agrobios Newsletter* 10(9): 81-82.

15) **Kumar A** and Dutta Jintu. 2012. Mechanisms of phosphorus solublisation and mobilization by AM fungi in soil. *Kisan Ki Awaaz- National Magazine of Farmers' Voice* 3(7): 27.

16) **Kumar A**, Suri VK and Yadav Arti. 2013. Impact of Climate Change on Soil Health and its Management *Kisan Ki Awaaz- National Magazine of Farmers' Voice* 4(1): 26-27.

17) **Kumar A**. 2013. Precision farming: Prospects and constraints in relation to mountain agriculture. *Kisan Ki Awaaz- National Magazine of Farmers' Voice* 4 (4): 25-26.

18) **Kumar A,** Suri VK and Choudhary AK. 2013. Mycorrhizal fungi: Magical fungus. *Kisan Ki Awaaz- National Magazine of Farmers' Voice* 4 (7): 30-32.

19) **Kumar A,** Yadav, Arti and Suri, V.K. 2013.*Kharif phaslon mein vagyanik vidhi se urvarak upyog mein la kar aaye badhayein* (Hindi). Kheti Duniyan18 (34): 24-08-2013 issue.

20) Dutta J and **Kumar A.** 2011. Prospective of conservation agriculture for sustainable development. *Agrobios Newsletter* 10(7): 19-21.

21) Suri VK and **Kumar A.** 2011. Mrida aivam jal srankhsan me jeevanu khadon ki bhumika. *Kheti Duniya* (23.04.2011). 17: 4.

22) Suri VK, **Kumar A,** Choudhary AK, Sepehya S and Yadav A. 2011. Professional aivum jaivik kheti ko apnakar khushhal banein. *Kheti Duniya (24.09.2011). 16(39): 11.*

23) Sepehya S, **Kumar A** and Sandal S. 2011. Shukhsam sinchai: Ek parichay. *Kheti Duniya* (17.09.2011). 15(39): 7.

24) Dutta J, **Kumar A**, Sharma U. 2012. Balanced plant nutrition for enhanced nutrient use efficiency and sustainable productivity. *Kisan Ki Awaaz- National Magazine of Farmers' Voice* 3(6): 19-20.

25) Singh N, **Kumar** A, Dhillon P, Pal S, Hassan SS, Singh N and Kumar B. 2017. Khetibadi shayik dhande, same di lodd. *Modern Kheti* 30 (3): 2017

26) Sharma U, Dutta J and **Kumar Anil**. 2013. Green manuring for enhancing and sustaining soil fertility. *Kisan Ki Awaaz- National Magazine of Farmers' Voice* 4(3): 25-26.

27) Sepehya S, Sandal S. **Kumar Anil** and Dhiman S. 2011. Polyhouse ke taihat kushal jal prabandhan takneekein. *Kheti Duniya* (24.09.2011). 16(39): 13.

Pamphlets/ leaflets (Extension literature developed)

28) **Kumar Anil,** Kumar, B and Brar, NS. 2018. Gandoa khaad: Mitti ate Faslan layi ek vardan. Krishi Vigyan Kendra and Directorate of Extension Education, GADVASU, Ludhiana (Booklet)

29) **Kumar Anil**, Brar NS and Kumar B. 2018. Khadan di santulit varton lai Mitti Parakh. Krishi Vigyan Kendra, GADVASU, Tarn Taran, Punjab

30) Brar NS, **Kumar A** and Kumar B. 2018. Canola saron di kasat. Krishi Vigyan Kendra, GADVASU, Tarn Taran, Punjab

31) Singh NS, Kumar B and **Kumar A.** 2017. Garmi rut di moongi di kaasat. Krishi Vigyan Kendra, GADVASU, Taran Taran, Punjab

32) Pal S, Kumar B, Hassan SS, Singh N and **Kumar A.** 2017. Broiler Murgi Palan, Krishi Vigyan Kendra, GADVASU, Tarn Taran, Punjab

33) Singh P, Singh N, Pal S and **Kumar A.** 2017. Pashuan nu makki da achar khaao sehatmand lavera ate dudh utpadan vdhao. Krishi Vigyan Kendra, GADVASU, Taran Taran, Punjab

34) Brar NS, Kumar B, Pal S and **Kumar A.** 2017. Dogle nepiar bajre di kaast. Krishi Vigyan Kendra, GADVASU, Taran Taran, Punjab

35) Singh P, Singh N, Pal S and **Kumar A.** 2016. Garmi rut di moongi di kaasat. Krishi Vigyan Kendra, GADVASU, Taran Taran, Punjab

36) Singh P, Singh N, Pal S and **Kumar A.** 2015. Hare Chare da Aachar Banauna. Krishi Vigyan Kendra, GADVASU, Taran Taran, Punjab

37) Singh P, Singh N, Pal S and **Kumar A.** 2015. Mitti di Sehat Sambhal. Krishi Vigyan Kendra, GADVASU, Taran Taran, Punjab

38) Sandal S, Bhushan L, Singh D, Kumar S, Sepehya S and **Kumar A**. 2011. Parvatia khsetron me versha jal ka srankhsit jutai dwara srankhsan, Deptt. of Soil Science, CSK HPKV Palampur (HP).

39) Sandal S, Katoch KK, Goel AK, Saroch K, **Kumar A** and Sepehya S. 2011. Parvatia khestron mein sinchai ke pramukh jal strot aivum unka pravandhan. Deptt. of Soil Science, CSK HPKV Palampur (HP).

Abstract Published or papers presented in seminars/conferences/symposiums)

1) Suri VK, Choudhary AK, Chander G and **Kumar Anil.** 2010. Impact of Co-inoculation of VA mycorrhizal (VAM) Fungi and Phosphate Solubilizing Bacteria (PSB) in Maize in an Acid Alfisol. In: *National Symposium on Emerging trends in Agricultural Research, Sept. 11-12, 2010* at Meerut, pp 88-89.

2) Suri VK and **Kumar Anil**. 2010. Managing Water Resources for Food Security in Changing Scenario. In: *National Symposium on Food Security in Context of Changing Climate, Oct. 30-Nov.01, 2010* at Kanpur, pp 33-34.

3) Suri VK, Choudhary AK, Chander G and **Kumar Anil.** 2010. Effect of VA-Mycorrhizal Fungi and Phosphorus Application through STCR Precision Model on Crop Productivity, Nutrient Uptake and Soil Fertility in Soybean (*Glycine max*) - Wheat (*Triticum aestivum*) - Soybean Crop Sequence in an Acid Alfisol. In: *National Seminar on Developments in Soil Science:* November 14-17, 2010 (75^{th} ISSS Annual Convention), New Delhi.

4) **Kumar Anil,** Suri VK and Yadav A. 2011. Phosphorus and rain-harvested water economy through Vesicular Arbuscular Mycorrhizae (VAM) in okra-pea sequence.In: *National Symposium-cum-Brainstorming Workshop on Organic Agriculture 19-20 April, 2011* at CSK HPKV Palampur, HP, pp 104.

5) **Kumar Anil,** Suri VK, Sandal S, Saroch K and Yadav A. 2011. Mitigating phosphorus and water stress through AM fungi in pea under changing climate. In: *International conference on "Issues for climate change, land use diversification and biotechnological tools for livelihood security",* October 08-10, 2011, SVPUAT, Meerut (UP), pp 8-9.

6) **Kumar Anil,** Parmar DK and Dutta J. 2011. Enhancing productivity of off-season cauliflower through boron and FYM under mid hill conditions of Western Himalays. *In: National Seminar on Developments in Soil Science:* November 16-19, 2011 (76th ISSS Annual Convention), UAS, Dharwad, Karnatka.

7) Suri VK, Choudhary AK and **Kumar Anil.** 2011. Effect of AM fungi (VAM) cultures from different farming situations on root colonization, productivity and soil fertility in soybean in P deficient acid Alfisol of NW Himalays. In: *National Seminar on Developments in Soil Science:* November 16-19, 2011 (76th ISSS Annual Convention), UAS, Dharwad, Karnatka.

8) Suri VK, Anil K Choudhary, Jaipaul and **Kumar Anil**. 2012. AM fungi spore population in different farming situations and their effect on productivity and nutrient dynamics in wet season crops in an acid Alfisols. In: *National Seminar on Indian Agriculture: Present situation, challenges, remedies and road map,* August 4-5, 2012, CSK HP Agricultural University Palampur (HP)- India, pp 21.

9) Suri,V.K., **Kumar, Anil,** Datt,N., Jaipaul and Choudhary, Anil K. 2012. Role of arbuscular mycorrhizal fungi in mitigating water stress in sustainable cropping systems under changing climate. Lead/ Invited Paper. National Symp. on Agril Production & Protection in context of climate change. (Nov. 3-5, 2012).BAU, Ranchi, Abstract pp 53.

10) Suri, V.K., Choudhary, **Anil K.,** Kumar, A. and Sidhu, G.S. 2013. Resource Vulnerabilities in Western Himalayas: Challenges and Mitigation Strategies. *In*: *International Conference on Impact of Technological Tools on Food Security under Global Warming Scenario (ITTFS 2012)*" held at Shobhit University, Modipuram, Meerut, India w.e.f. 11-12 May, 2013 organized by Hi-Tech Horticulture Society, Meerut & SRDA, Meerut in collaboration with SVBPUAT, Meerut & UPCAR, Lukhnow (UP). *International Conference Abstracts, Vol. I, pp*. 21*(Lead Lecture)*.

11) Suri, V.K., Choudhary, **Anil K.** and Kumar, Anil. 2013. Glycine-Glomus-Phosphate solubilizing bacteria interactions lead to fertilizer P economy in soybean (*Glycine max*. L.) in a Himalayan acid Alfisol. *In*: *International Conference on Impact of Technological Tools on Food Security under Global Warming Scenario (ITTFS 2012)*" held at Shobhit University, Modipuram, Meerut, India w.e.f. 11-12 May, 2013 organized by Hi-Tech Horticulture Society, Meerut & SRDA, Meerut in collaboration with SVBPUAT, Meerut & UPCAR, Lukhnow (UP). (Lead Paper).

12) Bengia, Bai, Suri, V.K., Choudhary, A.K. and **Kumar, A**. 2014. Effect of *Rhizobium* and AM fungi inoculation on growth, green pod yield and profitability of garden pea (*Pisum sativum*) in Himalayan acid Alfisol. *In Proc*.: National Seminar on Organic Agriculture – Challenges and Prospects, 28-29 May, 2014 at CSK HPKV, Palampur (HP). pp. 148-149.

13) **Kumar Anil**, Suri VK and Choudhary A.K. 2016. Nutritional Enrichment and Quality Enhancement through AM-fungi in Okra-Pea Cropping System in a Himalayan Acid Alfisol. In:

National Symposium on 'Transforming Indian agriculture towards food and nutritional security, February 19-20, 2016, IGFRI, Jhansi (UP), pp 105.

14) Suri VK, **Kumar A** and Choudhary AK. 2016. Role of AM-fungi in nutrient acquisition and drought tolerance under sustainable cropping system. In: *National Symposium on 'Transforming Indian agriculture towards food and nutritional security*, February 19-20, 2016, IGFRI, Jhansi (UP), pp 77. (**Invited/Lead Paper**).

15) **Kumar A**, Singh N, Singh P, Pal S and Gupta P. 2016. Assessment of available soil nutrients under rice-wheat cropping system in district Tarn Taran of Punjab. In: *National Symposium on 'Transforming Indian agriculture towards food and nutritional security*, February 19-20, 2016, IGFRI, Jhansi (UP), pp 114-115.

16) Singh N, **Kumar A**, Pal S and Singh P. 2016. Performance of different cultivars of kharif fodder maize under late sown conditions. In: *National Symposium on 'Transforming Indian agriculture towards food and nutritional security*, February 19-20, 2016, IGFRI, Jhansi (UP), pp 162-163.

17) **Kumar A**, Singh N, Pal S and Singh P. 2015. Available soil macro and micro nutrients under rice-wheat cropping system in district Tarn Taran of Punjab. In: *National Conference on 'Push to the livestock farming through knowledge empowerment of the farmers*, October 18-20, 2015, GADVASU, Ludhiana (Punjab), pp 264-265.

18) Singh N, Singh P, **Kumar A** and Pal S. 2015. Importance of silage feeding on milk production of HF crossbred dairy animals. In: *National Conference on 'Push to the livestock farming through knowledge empowerment of the farmers*, October 18-20, 2015, GADVASU, Ludhiana (Punjab), pp 264-265.

19) Pal S, Singh P, **Kumar A** and Singh N. 2015. Evaluation of clinical animal health problems reported at Krishi Vigyan Kendra Tarn Taran during 2014-15. In: *National Conference on 'Push to the livestock farming through knowledge empowerment of the farmers*, October 18-20, 2015, GADVASU, Ludhiana (Punjab), pp 281.

20) **Kumar A.,** Kumar B., Brar NS and Singh N. 2017. Assessment of Depth-wise Irrigation Water Quality for Fodder Production in District Tarn Taran of Punjab. *In*: National Symposium On New Directions in Managing Forage Resources and Livestock Productivity in 21st Century: Challenges and Opportunities. March 3-4, 2017, RVSKVV, Gwalior (MP), pp. 25.

21) Brar NS., Kumar B., Kaur J. and **Kumar A**. 2017. Qualitative investigation of Corn Silage from cattle farms in Majha region of Punjab. *In*: National Symposium On New Directions in Managing Forage Resources and Livestock Productivity in 21st Century: Challenges and Opportunities. March 3-4, 2017, RVSKVV, Gwalior (MP), pp. 132.

22) **Kumar Anil**, Singh NS and Kumar B. 2018. Impact of fertilizer recommendations based on Soil Health Card on fertilizer consumption, Productivity and Profitability of farmers – A case study. *In*: Improving Income of Farmers through Agriculture & Aquaculture through Development Interventions. January 05-07, 2018, ICAR-CIFA, Bhubaneswar, Odisha

23) Brar NS, **Kumar A** and Kumar B. 2017. Chemical control of *Phalaris minor* in wheat in semi-arid sub-tropical regions of northern India. *In:* International conference on Global Research Initiatives for Sustainable Agriculture and Allied Sciences during December 02-04, 2017 at MPUAT, Udaipur.

24) Kumar B, Brar NS and **Kumar A**. 2017. Effect of time of sowing on yield and economics of canola gobhi sarson cultivation at farmers' field in Tarn Taran district of Punjab. *In:* International conference on Global Research Initiatives for Sustainable Agriculture and Allied Sciences during December 02-04, 2017 at MPUAT, Udaipur.

10. Participation in trainings, Conferences/ Seminars/ Symposiums

1) Regional Seminar on Micro-irrigation in Himalayan States- Issues and Strategies, Feb 22-23, 2008. Organized by Department of Soil Science and Water Management, Dr YS Parmar University of Horticulture and Forestry, Nauni, Solan (HP)- India.

2) Chief Scientists' Meet on Water Management in Agriculture (AICRP on Water Management), June 24-28, 2010. Organized by Department of Soil Science CSK HP Agricultural University, Palampur (HP) and Directorate of Water Management (Bhubneshwer)- India.

3) National Symposium-cum-Brainstorming Workshop on Organic Agriculture, April 19-20, 2011. Organized by Organic Agricultural Society of India and Department of Organic Agriculture, CSK HP Agricultural University, Palampur (HP)- India.

4) International conference on Issues for climate change, land use diversification and biotechnological tools for livelihood security, October 08-10, 2011. Organized by Hi-Tech Horticultural Society and SVPUAT, Meerut (UP)- India.

5) National Seminar on Developments in Soil Science (76th ISSS Annual Convention), November 16-19, 2011. Organized by Indian Society of Soil Science (ISSS) and Department of Soil Science cum ISSS Dharwad Chapter, UAS, Dharwad (Karnatka)- India.

6) 8th International Conference on Plant and Soil Interaction at Low pH, Oct 18-22, 2012. Organized by UAS Banglore, ISSS, Banglore Chapter and International Steering Committee on Plant and Soil Interaction at Low pH, USA.

7) National Seminar on Developments in Soil Science (78th ISSS Annual Convention), October 23-26, 2013. Organized by Indian Society of Soil Science (ISSS) and Central Arid Zone Research Institute cum ISSS Jodhpur Chapter, CAZRI, Jodhpur (Rajasthan)- India.

8) National Symposium on 'Transforming Indian agriculture towards food and nutritional security, February 19-20, 2016, IGFRI, Jhansi (UP), Organised by Society of Agricultural Professionals, CSAUAT, Kanpur, India.

9) Fertilizer orientation course, September 13 & 14th, 2010. Organized by Fertilizer Association of India, New Delhi at CSK HPAU Palampur (HP).

10) Training Programme on 'Writing for Printing and Electronic Media', July 21-25, 2014. Organized by National Institute of Agricultural Extension Management (MANAGE), Hyderabad (Telangana).

11) Workshop on 'Extension Methodology', May 25-29, 2015. Organized by Punjab Agricultural Management and Extension Training Institute, Ludhiana.

12) ICAR training course on 'Advances in micro-irrigation and fertigation technologies for improving water and nutrient use efficiency, October 01-10, 2015. CSK HPKV, Palampur, HP- India.

13) ICAR Winter School on Diagnosis, Assessment and Management of Salt Affected Soils and Poor Quality Waters to Improve Productivity and Livelihood Security, November 11- December 01, 2014 at CSSRI, Karnal (Haryana).

14) Workshop cum training on Ideal livestock management for better animal production, March 25, 2016, Directorate of Ext. Edn., GADVASU, Ludhiana.

15) ICAR sponsored winter school on 'Innovations in Educational Technology', December 01-21, 2016, MPUAT, Udaipur, Rajasthan- India.

16) One Day Workshop on Entrepreneurship in Agriculture and Livestock Farming on 23.05.2017 at Harike Pattan, Tarn Taran.

17) Workshop on Action Plan 2017-18 of GADVASU's KVK, 13.06.2017 at KVK Barnala, Punjab.

18) Regional Workshop on Skill Development in Agriculture. September 15, 2017. Ministry of Agriculture and Farmers Welfare Govt of India and Department of Agriculture and Horticulture, Haryana.

19) One day Workshop on Appropriate Extension Methodologies for KVKs and University's Scientists. August 18, 2017. Directorate of Extension Education, GADVASU, Ludhiana.

20) Workshop on Paddy Straw Management. October 17, 2017. ICAR-ATARI Zone I, Ludhiana – India.

21) National Conference on Improving Income of Farmers through Agriculture & Aquaculture through Development Interventions. January 05-07, 2018, ICAR-CIFA, Bhubaneswar, Odisha

22) Regional Conference on Motivating and Attracting Youths in Agriculture organized by TAAS. August 30-31, 2018 at NASC (Pusa Complex), New Delhi.

23) International Conference on Global Research Initiatives for Sustainable Agriculture and Allied Sciences organized by Astha Foundation, Meerut (UP), October 28-30, 2018 at RARI, Durgapura, Jaipur, Rajasthan.

24) National Workshop on Development, Employment and Entrepreneurship: Emerging Realities organized by All India Progerssive Forum & GADVASU, Ludhiana, November 23-25, 2018 at GADVASU, Ludhiana.

11. Research Project Handed/Operational:

i. Working as **'Nodal Officer'** (with one other Scientist) in **Cluster Frontline Demonstrations Project on Pulses** and **Cluster Frontline Demonstrations Project on Oilseed** funded by Indian Council of Agricultural Research (ICAR). Under this scheme, crop diversification practices are being promoted via adoption of oilseed and pulses production technology through frontline demonstrations and adaptive research trials & also assessing technological and extension yield gaps in oilseeds & pulses in Tarn Taran district of Punjab.

ii. **Working as Co-PI** in Project on 'Promotion of agricultural mechanization for *In-situ* management of crop residue' funded by ICAR. Under this project awareness is being created among farmers

regarding paddy straw management through Method Demonstrations, training programmes, Farmer-Scientist Interphase, Group Discussion, Kisan Gosthis, and Awareness in Schools & Colleges.

iii. **Worked as member** in Project on National Initiative on Fodder Technology Demonstration implemented by ICAR-Indian Grassland and Forage Research Institute, Jhansi at KVK Tarn Taran. Conservation of green fodder as silage making to ensure year round fodder availability to dairy animals was major activity under said project. The scientific silage making was promoted among farmers and a very good impact of technology on farmers was registered.

iv. Centrally Sponsored Scheme on Soil Health Card (ICAR).

12. Technologies Explored/Developed:

i. Explored the possibility of INM module for okra-pea cropping system imbedded with VAM fungi and inorganic P (2009-11) – Doctoral Research (Ph.D.)

Explored, the possibility of integrated nutrient (INM) module for okra-pea cropping system imbedded with VAM fungi and inorganic P in an acid Alfisol of Western Himalayas. The research has comes up with significant findings i.e. P transformation in soil, improvement in the plant water relations, water use efficiency, soil physical properties, phosphorus use efficiency and profitability in okra–pea cropping system in Himalayan acid Alfisol.

- It is evident that research carried out involving mycorrhizal fungi biofertilizer has significant contribution on advancement of research of P transformation in soil, P use efficiency, plant water relations, etc.
- Findings of this work has been cited by several other researchers especially **phosphorus transformations** in soil (30 cross citations), **alteration in plant water relations** (24 cross citations) and **phosphorus use efficiency** (24 cross citations) using AM fungi.
- One publication of above work has also got Jagar Nath Raina Memorial **All India Best Publication Award** by Society for Advancement of Human and Nature, Solan.

This work is published in reputed international/ national journals (all having NAAS rating >6, Total 7 publications)

ii. Explored the possibility of INM module involving boron fertilization for off-season cauliflower - Master research (M.Sc.)

Cauliflower growing pocket (Kullu, HP) show regular boron deficiency in cauliflower. So, keeping this in view study was formulated to explore the possibility of INM module for off-season cauliflower involving boron fertilization and FYM. Above module improved marketable curd yield and quality, B use efficiency and overall returns of the farmers.

iii. Developing crop diversification module through oilseed and pulses cultivation in border belt of the Punjab (Cluster FLDs) – at KVK

These studies are in progress. Farmers are being motivated for crop diversification through conducting frontline demonstrations in their fields on oilseed and pulses. After getting good net returns and B:C ratio some famers are now changed their mind set from rice-wheat cropping system and have started involving oilseed and pulses in crop rotation.

iv. Soil test based fertilizer recommendation (Soil testing technology) – at KVK

Tarn Taran is one of the border district of Punjab having International boundary with Pakistan. The soil testing facilities for the farmers in the district were far away and no guidance on said aspect was available to the farmers. The Krishi Vigyan Kendra (KVK), Tarn Taran approached the farmers and motivated them for soil testing, after that KVK has issued soil health card to the farmers based on soil testing, where recommendations on nutrients application have been provided.

A good on socio-economic impact of soil testing on fertilizer saving and farmers' income has registered, which is briefly described below:

Socio-economic impact of the Soil Testing Technology transferred

A thorough study was undertaken to assess the knowledge levels and knowledge upgradation of the farmers about soil testing. After providing recommendations as per soil test, a critical interpretation of the results was provided to the farmers. The farmers started the follow up of fertilizer recommendations given in soil health card. Because of good profits, the farmers started motivating fellow farmers to adopt soil test based fertilizer application in different crops to get more crop productivity and sustaining soil health.

Due to regular motivation of farmers' through various types of extension activities, others farmers also attracted towards soil testing. *The year-wise farmers' numbers motivated towards soil testing are increasing day by day. Till date 1350 soil health cards have been issued to the farmers of district Tarn Taran since 2014-15.* To study the impact of technology transfer data was collected randomly from 75 (n = 75) farmers to test the level of adoption or to study the impact of technology on fertilizer consumption, productivity and profitability of farmers of the district after 3 years.

- Till 2014-15, farmers generally used to apply 372.3 and 156.3 kg urea and di-ammonium phosphate, respectively in wheat crop, whereas the usage of said fertilizers in paddy was to the extent of 371.0 and 62.5 kg per hectare, respectively.
- The total cost of cultivation of rice-wheat cropping system was ₹73,765/-.
- The farmers were advised to apply fertilizers based on soil health card.
- The fertilizer dose came down to 275 kg urea and 10 kg Zn per hectare for paddy and 275 kg urea and 125 kg DAP in case of wheat, indicating a net saving of ₹4,414/- per hectare per annum.

- Use of soil health card also improved soil health of the field resulting into additional crop yields with time.
- Continuous application of soil test based fertilizer resulted in increased productivity of rice and wheat to the tune of 70.0 to 76.3 and 47.5 to 51.9 q ha^{-1}, respectively.
- The respective net returns and B:C ratio of rice-wheat cropping system has also increased significantly to ₹1,24,986 and 2.80 as compared to earlier net returns and B:C ratio of ₹1,04,264 and 2.41, respectively (Table 1).
- The production and monetary efficiencies of rice-wheat cropping system were increased by 9.2 and 19.5% after fertilizer application based on soil test (Table 2)
- Because of huge profits, the farmers started motivating fellow farmers to adopt soil test based fertilizer application in different crops to get more crop productivity and sustaining soil health.

Other related information:

- Promoting biofertilizer and vermicompost technology among farmers through frontline demonstrations in different crops
- Promoting soil test based fertilizer application in agricultural and horticultural crops through soil testing
- Research Gate Score: 17.06; Citations: 221; Issued 1404 Soil Health Cards to the farmers since 2015 at KVK
- **Conducted M.Sc. Thesis Viva** at Lovely Professional University, Jalandhar (Punjab) on 20.06.2015 & 11.07.2015
- **Appeared in 3 TV programmes** telecasted on **Doordarshan (DD Punjabi)** in Mera Pind Mere Khet Programme.
- Delivered Expert lecture on 'Mycorrhizal fungi' at Indian Agricultural Research Institute (IARI, New Delhi) in a Model Training Course and expert lecture on 'Celery' in training programme organised by Spice Borad of India.
- Submitted research proposal concept note to university funded under RKVY on improvement of soil permeability.

I hereby certify that the above mentioned information furnished above by me is true and correct.

(Anil Kumar)

LIST OF PUBLICATIONS

Research/Review Papers Published

	Details of Publications	NAAS Rating (2018)
1.	**Kumar, A**., Choudhary, A.K. and Suri, V.K. 2017 Agronomic bio–fortification and quality enhancement in okra–pea cropping system through arbuscular mycorrhizal fungi at varying phosphorus and irrigation regimes in Himalayan acid Alfisol. *Journal of Plant Nutrition* DOI:10.1080/01904167.2016.1267208.	**6.62**
2.	**Kumar, A**., Choudhary, A.K and Suri, V.K. 2016. Influence of AM fungi, inorganic phosphorus and irrigation regimes on plant water relations and soil physical properties in okra (Abelmoschus esculentus l.) – pea (Pisum sativum l.) cropping system in Himalayan acid Alfisol. *Journal of Plant Nutrition* 39 (05):666-682. DOI:10.1080/01904167.2015.1087030.	**6.62**
3.	**Kumar, A.,** Choudhary, A.K., Suri, V.K. and Rana, K.S. 2016. AM fungi lead to fertilizer phosphorus economy and enhanced system productivity and profitability in okra (Abelmoschus esculentus) – pea (Pisum sativum) cropping system in Himalayan acid Alfisol. *Journal of Plant Nutrition* 39(10): 1380-1390. DOI: 10.1080/01904167.2015.1143499.	**6.62**
4.	**Kumar, A.,** Suri, V.K., Choudhary, A.K., Yadav, A., Kapoor, R., Sandal, S. and Dass, A. 2015. Growth behavior, nutrient harvest index and soil fertility in okra–pea cropping system as influenced by AM fungi, applied phosphorus and irrigation regimes in Himalayan acid Alfisol. *Communications in Soil Science and Plant Analysis* 46 (17): 2212-2233. [DOI: 10.1080/00103624.2015.1069323].	**6.59**
5.	**Kumar, A.,** Suri, V.K., and Choudhary, A.K. 2014. Influence of inorganic phosphorus, VAM fungi, and irrigation regimes on crop productivity and phosphorus transformations in okra (Abelmoschus esculentus L.)–pea (Pisum sativum L.) cropping system in an Acid Alfisol. *Communications in Soil Science and Plant Analysis* 45 (7): 953-967. [DOI:10.1080/00103624.2013.874025].	**6.59**
6.	**Kumar, A.,** Choudhary, A.K. and Suri, V.K. 2015. Influence of AM–fungi and applied phosphorus on growth indices, production efficiency, phosphorus–use efficiency and fruit–succulence in okra (Abelmoschus esculentus)–pea (Pisum sativum) cropping system in an acid Alfisol. *Indian Journal of Agricultural Sciences* 85 (8): 1030-1037.	**6.22**
7.	**Kumar, A.,** Choudhary, A.K. and Suri, V.K. 2016. Influence of AM fungi and inorganic phosphorus on fruit characteristics, root morphology, mycorrhizal colonization and soil phosphorus in okra–pea production system in Himalayan acid Alfisol. *Indian Journal of Horticulture* 73(2): 213-218. DOI: 10.5958/0974-0112.2016.00050.5.	**6.15**
8.	Yadav, A., Suri, V.K., **Kumar, A** and Choudhary, A.K. 2017. Effect of AM fungi and phosphorus fertilization on P-use efficiency, nutrient acquisition and root morphology in pea (*Pisum sativum* L.) in an acid Alfisol. *Journal of Plant Nutrition* 41 (6): 689-701. DOI:10.1080/01904167.2017.1406107].	**6.62**

9. Bai, B., Suri, V.K., **Kumar, A.** and Choudhary, A.K. 2016c. Tripartite symbiosis of Pisum–Glomus–Rhizobium lead to enhanced productivity, nitrogen and phosphorus economy, quality and biofortification in garden pea in a Himalayan acid Alfisol. *Journal of Plant Nutrition* 39: 666-682. **6.62**

10. Bai, B., Suri, V.K., **Kumar, A**. and Choudhary, A.K. 2016a. Influence of dual–inoculation of AM fungi and Rhizobium on growth indices, production economics and nutrient use efficiencies in garden pea (Pisum sativum L.*). Communications in Soil Science and Plant Analysis* 47: 941-954. **6.59**

11. Bai, B., Suri, V.K., **Kumar, A.** and Choudhary, A.K. 2016b. Influence of Glomus–Rhizobium symbiosis on productivity, root morphology and soil fertility in garden pea in Himalayan acid Alfisol. *Communications in Soil Science and Plant Analysis* 47: 787-798. **6.59**

12. Suri, V.K., Choudhary, A.K. and **Kumar, A.** 2013. VAM fungi spore populations in different farming situations and their effect on productivity and nutrient dynamics in maize and soybean in Himalayan acid Alfisol. *Communications in Soil Science and Plant Analysis*. 44 (22): 3327-3339, [DOI: 10.1080/ 00103624. 2013.848283] **6.59**

13. Yadav, A., Suri, V.K., **Kumar, A.** Choudhary, A.K. and Meena, A.L. 2015. Enhancing plant water relations, quality and productivity of pea (Pisum sativum L.) through AM fungi, inorganic phosphorus and irrigation regimes in a Himalayan acid Alfisol. *Communications in Soil Science and Plant Analysis* 46 (1): 80-93. [DOI:10.1080/00103624.2014.956888]. **6.59**

14. Basu, PS., Singh U., **Kumar A.**, Praharaj CS and Shivran RK. 2016. Climate change and its mitigation strategies in pulses production. *Indian Journal of Agronomy* 61: 71-82 **5.46**

15. Yadav, A., Suri, V.K., **Kumar, A.** and Choudhary, A.K. 2015. Influence of AM fungi and inorganic phosphorus on growth, green pod yield and profitability of pea (Pisum sativum L.) in Himalayan acid Alfisol. *Indian Journal of Agronomy* 60 (1): 163-167. **5.46**

16. **Kumar A,** Prakash B, Brar NS and Kumar B. 2018. Potential of vermicompost for sustainable crop production and soil health improvement in different cropping systems. International Journal of Microbiology and Applied Sciences 7(10): 1042-1055. **5.38**

17. Brar NS, **Kumar A** and Kumar B. 2017. Performance of summer mungbean (Vigna radiata L.) under different sowing time at farmers' field. *International Journal of Current Microbiology and Applied Sciences* 6 (8): 2211-2219. **5.38**

18. **Kumar A**, Parmar DK and Kiran. 2013. Response of off-season cauliflower (Brassica oleracea var. botrytis) to boron and organic manure nutrition under mid hill conditions of Himachal Pradesh (Short Communication). *Journal of the Indian Society of Soil Science* 61(2): 158-160. **5.23**

19. Kapoor R, Sandal SK, Sharma SK, **Kumar A** and Saroch K. 2014. Effect of varying drip irrigation levels and NPK fertigation on soil water dynamics, productivity and water use efficiency of cauliflower in wet temperate zone of Himachal Pradesh. *Indian Journal of Soil Conservation* 42 (3): 249-254. **5.20**

20. Brar NS, Kumar B, Singh P, **Kumar A** and Singh P. 2017. Qualitative assessment of silage prepared at farmers' field in Tarn Taran district of Punjab. *Indian Journal of Animal Nutrition* 34 (3): 357-360. **5.02**

21. **Kumar A**, Brar NS, Pal S and Singh P. 2017. Available soil macro and micro-nutrients under rice wheat cropping system in District Tarn Taran of Punjab. *Ecology, Environment and Conservation* 23 (1): 229-234. **4.89**

22. Suri VK, **Kumar A** and Choudhary AK. 2017. AM-fungi lead to better plant nutrient acquisition and drought tolerance in agricultural crops: A review. *Current Advances in Agricultural Sciences- An International Journal* 9 (1): 1-12 **4.69**

23. Choudhary AK, Pooniya V, Bana RS, **Kumar A** and Singh U. 2014. Mitigating pulse productivity constraints through phosphorus fertililization- A review. *Agricultural Review* 35(4): 314-319. **4.37**

24. Suri VK and **Kumar Anil**. 2013. Role of vesicular arbuscular mycorrhizae (VAM) in meeting phosphors needs of important crops and cropping systems. *Progressive Agriculture- An International Journal* 13(1): 67-72. **4.29**

25. Suri, VK, **Kumar Anil** and Choudhary AK. 2012. Soil Health Management through Carbon Sequestration under Changing Climatic Scenario. Lead paper ICLDBT International Symposium published during Sept., 2012 in *Progressive Agriculture- An International Journal*. 11 (Conf. issue): 29-42. **4.29**

26. Sandal SK, Saini K, **Kumar Anil**, Kumar N and Sharma SK. 2012. Effect of fertilizer recommendations and tillage manipulation on productivity and nutrient uptake of rainfed wheat (Triticum aestivum) in an Alfisol. *Agropedology* 22(2): 11-11. **4.16**

27. Brar NS, Kumar B, **Kumar A**, Singh P and Pal S. 2016. Performance of different cultivars of Kharif fodder maize under late sown conditions of Punjab. *International Journal of Farm Sciences* 6 (4): 1-6. **4.01**

28. Prakash B, Khairnar SO, Mandal A, **Kumar A** and Kumar B. 2018. Composite fish farming: A review on economic enterprise for rural empowerment and livelihood generation. *International Journal of Fisheries and Aquatic Studies* 6(4): 545-550. **3.99**

29. Brar NS, Singh P, **Kumar A**, Kumar B and Pal S. 2016. Maize silage feeding vis-a-vis milk production in cross bred dairy cows in Tarn Taran district of Punjab. *Progressive Research* 11: 269-70. **3.84**

30. **Kumar A.** and Parmar DK. 2014. Influence of boron and organic manure nutrition on productivity, nutrient uptake and soil properties in autumn cauliflower under western Himalayas conditions. *International Journal of Tropical Agriculture* 32 (3-4): 695-705. **3.49**

31. **Kumar A**, Parmar DK and Suri VK. 2011. Effect of boron fertilizers and organic manure on autumn cauliflower in Western Himalayas. *Annals of Horticulture* 5 (1): 17-24. **3.42**

32. **Kumar Anil**, Suri VK, Sandal S, Saroch K and Yadav A. 2012. Phosphorus transformation in an acid soil of Western Himalayas as influenced by its application along with VAM in okra-pea sequence. In: *8th International Conference on Plant and Soil Interaction at Low pH* held at UAS, Banglore 18-22 Oct 2012 p. 278-279. --

33. Pierre MJ, Bhople BS, **Kumar Anil**, Erneste H, Emmanuel B and Singh YN. 2014. Contribution of Arbuscular Mycorrhizal Fungi (AM Fungi) and Rhizobium Inoculation on Crop Growth and Chemical Properties of Rhizospheric Soils in High Plants. *IOSR Journal of Agriculture and Veterinary Science* 7: 45-55. -

34. Bhople BS, Adhikari K, **Kumar Anil**, Singh A and Singh G. 2014. Sub-Surface Method of Irrigation- Clay Pipe Irrigation System. *IOSR Journal of Agriculture and Veterinary Science* 7: 60-62. --

Book Chapters Published:

1) **Kumar A** and Choudhary AK. 2018. AM Fungi: A Potential Myco-Biofertilizer for Nutrient and Water Acquisition in Rainfed and Dryland Ecologies. *In*: Climate resilient agro-technologies for enhanced crop and water productivity under water-deficit agro-ecologies' (ISBN 978-93-83168- 31-6) (Rana KS *et al.*), ICAR-Indian Agricultural Research Institute, New Delhi. pp 99-111.

2) **Kumar, A.,** Choudhary, A.K., Pooniya, V., Suri, V.K. and Singh, U. 2016 (***Springer***). Soil Factors Associated with Micronutrient Acquisition in Crops- Biofortification Perspective. Biofortification of Food Crops by Singh et al., pp 159-176. ISBN: 978-81-322-2714-4 (Print) 978-81-322-2716-8 (Online) DOI 10.1007/978-81-322-2716-8_13. URL: http://link.springer.com/book/10.1007/978-81-322-2716-8.

3) **Kumar A** and Anil K. Choudhary. 2014. Scientific Cultivation of Vegetable Pea (Pisum sativum L.). pp 45-54. In: Choudhary, A.K., Rana, K.S., Dass, A., Srivastav, M. (Eds.). Advances in Vegetable Agronomy. [ISBN: 978-93-83168-17-0]. Post Graduate School, IARI, New Delhi & ICAR, New Delhi, India. 358 p.

4) **Kumar A** and Bhople BS. 2015. Effective moisture conservation practices for mitigating soil water stress under changing climate. In: In: Environmental Science and Engineering (vol 12) *Climate Change and Sustainable Technology*, pp 91-105.

5) **Kumar A**, *Anil K. Choudhary and S. Rahi. 2014.* Scientific Cultivation of Broccoli (*Brassica oleracea* L. *var. italica*) pp 87-91. In: Choudhary, A.K., Rana, K.S., Dass, A., Srivastav, M. (Eds.). Advances in Vegetable Agronomy. [ISBN: 978-93-83168-17-0]. Post Graduate School, IARI, New Delhi & ICAR, New Delhi, India. 358 p.

6) **Kumar A**, *Anil K. Choudhary and S. Rahi. 2014.* Scientific Cultivation of Brussels sprouts (*Brassica oleracea* L. *var. gemmifera*) pp 92-95. In: Choudhary, A.K., Rana, K.S., Dass, A., Srivastav, M. (Eds.). Advances in Vegetable Agronomy. [ISBN: 978-93-83168-17-0]. Post Graduate School, IARI, New Delhi & ICAR, New Delhi, India. 358 p.

7) **Kumar A**, *Anil K. Choudhary and S. Rahi. 2014.* Scientific Cultivation of Knol-Khol (*Brassica oleracea* L. *var. gongylodes*) pp 96-99. In: Choudhary, A.K., Rana, K.S., Dass, A., Srivastav, M. (Eds.). Advances in Vegetable Agronomy. [ISBN: 978-93-83168-17-0]. Post Graduate School, IARI, New Delhi & ICAR, New Delhi, India. 358 p.

8) **Kumar A** *and Anil K. Choudhary. 2014.* Scientific cultivation of Okra (*Abelmoschus esculentus* L.) pp 255-259. In: Choudhary, A.K., Rana, K.S., Dass, A., Srivastav, M. (Eds.). Advances in Vegetable Agronomy. [ISBN: 978-93-83168-17-0]. Post Graduate School, IARI, New Delhi & ICAR, New Delhi, India. 358 p.

9) **Kumar A**, Anil K. Choudhary, VK Suri, RS Bana, Vijay Pooniya and Ummed Singh. 2014. Site specific Water Management for Sustainable Agriculture pp 327-336. In: M.S. Meena, K.M. Singh and B.P. Bhatt (Eds.). Water Management in Agriculture.

10) **Kumar** A and Sharma M. 2016. Tie-up with foreign agricultural institutes for higher education. In: *ICAR sponsored Winter School on Innovations in Educational Technology*, December 01 – 21, 2016, RCA, MPUAT, Udaipur, India, pp. 47-52.

11) Suri VK and **Kumar A.** 2011. Potential of Integrated Nutrient Supply and Soil Health Improvement in Sustainable Cropping Systems of Indian Himalayas. In: *Sustainable Hill Agriculture: An overview* (Anil Kumar *et al.* eds.), Agrobios (India), pp. 123-149.

12) Suri VK and **Kumar A**. 2011. Managing Water Resources for Food Security in Changing Scenario. In: *Climate change and food security in India* (Tripathi AK and Pathak H. eds), The Society of Agricultural Professionals, CSAUAT, Kanpur, India, pp. 112-126.

13) Suri VK, Sidhu GS and **Kumar A**. 2013. Physical attributes: Soil and landscape characteristics of western Himalayan region of India *In:* Climate Change and its Ecological Implications for the Western Himalaya (Ed. Chopra VL), Scientific Publishers, Jodhpur, ISBN No. 978-81-72338-09-1, pp 1-48.

14) Suri VK, **Kumar A** and Choudhary 2017. Arbuscular Mycorrhizal Fungi: An Eco-Friendly Bio-Resource for Enhancing Nutrient Use Efficiency and Drought Tolerance in Agricultural Crops. *In:* Mycorrhizal Fungi (Aggarwal and Yadav Eds.), Astral International Pvt. Ltd., New Delhi, pp. 291-309.

15) Sharma M and **Kumar A**. 2016. Use of Photography in developing visual aids for effective communication. In: *ICAR sponsored Winter School on Innovations in Educational Technology*, December 01 – 21, 2016, RCA, MPUAT, Udaipur, India, pp. 41-46.

16) Choudhary AK, Pooniya V, Rahi S and **Kumar A**. 2014. Agronomic Practices of Vegetable Crops. In: Natural Resource Management for Sustainable Agriculture (Ed. Rana et al), Venus Publishers, New Delhi, ISBN No. 978-93-83168-06-4, pp 29-35.

17) Sandal SK, Sepehya S and **Kumar Anil**. 2010. Efficient water management techniques under poly house conditions. In: *Summer School on Protected Cultivation for Enhanced Profitability* (Sept 3-23, 2010) Deptt of Vegetable Sciences and Floriculture, CSK HPKV Palampur, pp. 43-48.

18) Choudhary AK, Pooniya V, Bana RS and **Kumar A**. 2014. Efficient Utilization of Organic Wastes and their Impact on Soil Health. In: Natural Resource Management for Sustainable Agriculture (Ed. Rana et al), Venus Publishers, ISBN No. 978-93-83168-06-4, pp 198-202.

19) Choudhary AK, Rahi S and **Kumar A**. 2014. Integrated Nutrient Management in Vegetable Crops. In: Advances in Field Crop Production (Ed. Rana et al), Venus Publishers, ISBN No. 978-93-83168-08-8, pp 29-35.

20) *Savita, Jaipaul, Anil K. Choudhary and Mahendra Singh Negi and* **Kumar A**. *2014.* Scientific Cultivation of Cauliflower (*Brassica oleracea* L. var. *botrytis*) pp 67-78. In: Choudhary, A.K., Rana, K.S., Dass, A., Srivastav, M. (Eds.). Advances in Vegetable Agronomy. [ISBN: 978-93-83168-17-0]. Post Graduate School, IARI, New Delhi & ICAR, New Delhi, India. 358 p.

21) *Savita, Jaipaul, Anil K. Choudhary, Mahendra Singh Negi and* **Kumar A**. *2014.* Scientific Cultivation of Cabbage (*Brassica oleracea* L. var. *capitata*) pp 79-86. In: Choudhary, A.K., Rana,

K.S., Dass, A., Srivastav, M. (Eds.). Advances in Vegetable Agronomy. [ISBN: 978-93-83168-17-0]. Post Graduate School, IARI, New Delhi & ICAR, New Delhi, India. 358 p.

22) Havugimana E, Bhople BS, **Kumar A,** Byiringiro E, Mugabo JP and Kumar A. 2015. Soil pollution - Major sources and types of soil pollutants. In: Environmental Science and Engineering (vol 11): *Soil Pollution and Phytoremediation, pp 53-86.*

23) Anil K. Choudhary, V.K. Suri and **Kumar A**. 2014. Soil and Fertilizer Management in Horticultural Crops. pp 175-185. In: Srivastav, M., Choudhary, A.K., Rana, K.S., Dass, A. (Eds.). Agronomy of Horticultural Crops [ISBN: 978-93-83168-19-4]. Post Graduate School, IARI, New Delhi & ICAR, New Delhi, India. 210p.

24) Choudhary AK, Ranjana GA and **Kumar A.** 2018. Soil fertility management under ICM. *In*: Integrated Crop Management Practices for Enhancing Productivity, Resource-Use Efficiency, Soil Health and Livelihood Security (ISBN 978-93- 83168-32-3) (Eds. Choudhary AK *et al.*), ICAR–Indian Agricultural Research Institute, New Delhi. pp 33-39.

Extension/popular Articles Published

1) **Kumar A** and Kumar B. 2018. Injh banao change gunbata di gandoa khaad. *Modern Kheti* 31(11): 50-51.

2) **Kumar A.** 2018. Khadan di santulit varton lai jaruri hai Mitti Parakh. *Krishi Jagran* 20(2): 42-44.

3) **Kumar A**, Kumar B, Singh N and Singh N. 2017. Jeevanu khadon ka mrida aivam jal sarankshan me mehtab. *Kheti Duniya* 22.4.2017, pp.2.

4) **Kumar A**, Kumar B and Pal S. 2017. Mrida Sukhsham jeevon ki mehtabta ko jane. *Kheti Duniya* 1(8): 4.

5) **Kumar A** and Kumar B. 2017. Hari khad ugayein, mrida urbarta badhayein. *Modern Kheti* 15 (8): 42.

6) **Kumar A**, Nisha, Choudhary AK and Suri VK. 2017. Impact of global warming on soil microbial community. *Indian Farming* 67 (4): 9-10.

7) **Kumar A**. 2014. Mrida Jaanch Karwayen Unnat Kheti Ki Taraf kadam bhadhayen. *Kheti dunia* (13.12.2014), 19(50): 7.

8) **Kumar A**, Nisha, Suri VK and P.Singh. Kenhua khaad: ek upyogi vikalp. *Kheti dunia* (22.11.2014), 19(47): 3.

9) **Kumar A**, Singh N and Singh P. 2015. Mitti Parakh: Unnat kheti vale k kadam. *Kheti dunia* (04.07. 2015), 33(27): 10.

10) **Kumar A** and Kumar B. 2017. Pashuyan de gohe di bnauo gandoya khaad ta jo bhoomi di sehat rhe barkrar. *Vigiyanak Pashu Palan* **11**(2): 18-20

11) **Kumar A**, Pal S and Kumar B. 2017. Vermicompost: A promising input for agricultural and horticultural crop. Livestock Technology 3(7): 60-61.

12) **Kumar A** and Kumar B. 2017. Swasth mrida aivam tikayu kheti ka aadhar kenchua khad. Modern Kheti.

13) **Kumar A,** Suri VK. 2010. VAM jeevanu khad ka upyog karke yun badhayen aay. *Kheti Duniya* (15.05.2010). 20: 7.

14) **Kumar A,** Suri VK, Dutta J, Sepehya S, and Sandal S. 2012. Mrida urbarta badhane ke liye Karen zaibik khadon ka upyog. *Kisan ki Awaaz***,** *National Magazine of Farmers' Voice* 3(2): 12-13.

15) **Kumar A** and Dutta Jintu. 2012. Water management in hills and cold deserts regions of Western Himalayas. *Agrobios Newsletter* 10(9): 81-82.

16) **Kumar A** and Dutta Jintu. 2012. Mechanisms of phosphorus solublisation and mobilization by AM fungi in soil. *Kisan Ki Awaaz- National Magazine of Farmers' Voice* 3(7): 27.

17) **Kumar A**, Suri VK and Yadav Arti. 2013. Impact of Climate Change on Soil Health and its Management *Kisan Ki Awaaz- National Magazine of Farmers' Voice* 4(1): 26-27.

18) **Kumar A**. 2013. Precision farming: Prospects and constraints in relation to mountain agriculture. *Kisan Ki Awaaz- National Magazine of Farmers' Voice* 4 (4): 25-26.

19) **Kumar A,** Suri VK and Choudhary AK. 2013. Mycorrhizal fungi: Magical fungus. *Kisan Ki Awaaz- National Magazine of Farmers' Voice* 4 (7): 30-32.

20) **Kumar A,** Yadav, Arti and Suri, V.K. 2013.*Kharif phaslon mein vagyanik vidhi se urvarak upyog mein la kar aaye badhayein* (Hindi). Kheti Duniyan18 (34): 24-08-2013 issue.

21) Dutta J and **Kumar A.** 2011. Prospective of conservation agriculture for sustainable development. *Agrobios Newsletter* 10(7): 19-21.

22) Suri VK and **Kumar A.** 2011. Mrida aivam jal srankhsan me jeevanu khadon ki bhumika. *Kheti Duniya* (23.04.2011). 17: 4.

23) Suri VK, **Kumar A,** Choudhary AK, Sepehya S and Yadav A. 2011. Professional aivum jaivik kheti ko apnakar khushhal banein. *Kheti Duniya (24.09.2011). 16(39): 11.*

24) Sepehya S, **Kumar A** and Sandal S. 2011. Shukhsam sinchai: Ek parichay. *Kheti Duniya* (17.09.2011). 15(39): 7.

25) Dutta J, **Kumar A**, Sharma U. 2012. Balanced plant nutrition for enhanced nutrient use efficiency and sustainable productivity. *Kisan Ki Awaaz- National Magazine of Farmers' Voice* 3(6): 19-20.

26) Singh N, **Kumar** A, Dhillon P, Pal S, Hassan SS, Singh N and Kumar B. 2017. Khetibadi shayik dhande, same di lodd. *Modern Kheti* 30 (3): 2017

27) Sharma U, Dutta J and **Kumar Anil**. 2013. Green manuring for enhancing and sustaining soil fertility. *Kisan Ki Awaaz- National Magazine of Farmers' Voice* 4(3): 25-26.

28) Sepehya S, Sandal S. **Kumar Anil** and Dhiman S. 2011. Polyhouse ke taihat kushal jal prabandhan takneekein. *Kheti Duniya* (24.09.2011). 16(39): 13.

Pamphlets/ leaflets (Extension literature developed)

29) **Kumar Anil,** Kumar, B and Brar, NS. 2018. Gandoa khaad: Mitti ate Faslan layi ek vardan. Krishi Vigyan Kendra and Directorate of Extension Education, GADVASU, Ludhiana (Booklet)

30) Brar NS, **Kumar A** and Kumar B. 2019. Happy seeder naal kanak di bijai. Krishi Vigyan Kendra and Directorate of Extension Education, GADVASU, Ludhiana.

31) **Kumar Anil**, Brar NS and Kumar B. 2018. Khadan di santulit varton lai Mitti Parakh. Krishi Vigyan Kendra, GADVASU, Tarn Taran, Punjab

32) Brar NS, **Kumar A** and Kumar B. 2018. Canola saron di kasat. Krishi Vigyan Kendra, GADVASU, Tarn Taran, Punjab

33) Singh NS, Kumar B and **Kumar A.** 2017. Garmi rut di moongi di kaasat. Krishi Vigyan Kendra, GADVASU, Taran Taran, Punjab

34) Pal S, Kumar B, Hassan SS, Singh N and **Kumar A.** 2017. Broiler Murgi Palan, Krishi Vigyan Kendra, GADVASU, Tarn Taran, Punjab

35) Singh P, Singh N, Pal S and **Kumar A.** 2017. Pashuan nu makki da achar khaao sehatmand lavera ate dudh utpadan vdhao. Krishi Vigyan Kendra, GADVASU, Taran Taran, Punjab

36) Brar NS, Kumar B, Pal S and **Kumar A.** 2017. Dogle nepiar bajre di kaast. Krishi Vigyan Kendra, GADVASU, Taran Taran, Punjab

37) Singh P, Singh N, Pal S and **Kumar A.** 2016. Garmi rut di moongi di kaasat. Krishi Vigyan Kendra, GADVASU, Taran Taran, Punjab

38) Singh P, Singh N, Pal S and **Kumar A.** 2015. Hare Chare da Aachar Banauna. Krishi Vigyan Kendra, GADVASU, Taran Taran, Punjab

39) Singh P, Singh N, Pal S and **Kumar A.** 2015. Mitti di Sehat Sambhal. Krishi Vigyan Kendra, GADVASU, Taran Taran, Punjab

40) Sandal S, Bhushan L, Singh D, Kumar S, Sepehya S and **Kumar A**. 2011. Parvatia khsetron me versha jal ka srankhsit jutai dwara srankhsan, Deptt. of Soil Science, CSK HPKV Palampur (HP).

41) Sandal S, Katoch KK, Goel AK, Saroch K, **Kumar A** and Sepehya S. 2011. Parvatia khestron mein sinchai ke pramukh jal strot aivum unka pravandhan. Deptt. of Soil Science, CSK HPKV Palampur (HP).

Abstract Published or papers presented in seminars/conferences/symposiums)

1) Suri VK, Choudhary AK, Chander G and **Kumar Anil.** 2010. Impact of Co-inoculation of VA mycorrhizal (VAM) Fungi and Phosphate Solubilizing Bacteria (PSB) in Maize in an Acid Alfisol. In: *National Symposium on Emerging trends in Agricultural Research, Sept. 11-12, 2010* at Meerut, pp 88-89.

2) Suri VK and **Kumar Anil**. 2010. Managing Water Resources for Food Security in Changing Scenario. In: *National Symposium on Food Security in Context of Changing Climate, Oct. 30- Nov.01, 2010* at Kanpur, pp 33-34.

3) Suri VK, Choudhary AK, Chander G and **Kumar Anil.** 2010. Effect of VA-Mycorrhizal Fungi and Phosphorus Application through STCR Precision Model on Crop Productivity, Nutrient Uptake and Soil Fertility in Soybean (*Glycine max*) - Wheat (*Triticum aestivum*) - Soybean Crop Sequence in an Acid Alfisol. In: *National Seminar on Developments in Soil Science:* November 14-17, 2010 (75th ISSS Annual Convention), New Delhi.

4) **Kumar Anil,** Suri VK and Yadav A. 2011. Phosphorus and rain-harvested water economy through Vesicular Arbuscular Mycorrhizae (VAM) in okra-pea sequence.In: *National Symposium-cum-Brainstorming Workshop on Organic Agriculture 19-20 April, 2011* at CSK HPKV Palampur, HP, pp 104.

5) **Kumar Anil,** Suri VK, Sandal S, Saroch K and Yadav A. 2011. Mitigating phosphorus and water stress through AM fungi in pea under changing climate. In: *International conference on "Issues for climate change, land use diversification and biotechnological tools for livelihood security",* October 08-10, 2011, SVPUAT, Meerut (UP), pp 8-9.

6) **Kumar Anil,** Parmar DK and Dutta J. 2011. Enhancing productivity of off-season cauliflower through boron and FYM under mid hill conditions of Western Himalays. *In: National Seminar on Developments in Soil Science:* November 16-19, 2011 (76th ISSS Annual Convention), UAS, Dharwad, Karnatka.

7) Suri VK, Choudhary AK and **Kumar Anil.** 2011. Effect of AM fungi (VAM) cultures from different farming situations on root colonization, productivity and soil fertility in soybean in P deficient acid Alfisol of NW Himalays. In: *National Seminar on Developments in Soil Science:* November 16-19, 2011 (76th ISSS Annual Convention), UAS, Dharwad, Karnatka.

8) Suri VK, Anil K Choudhary, Jaipaul and **Kumar Anil**. 2012. AM fungi spore population in different farming situations and their effect on productivity and nutrient dynamics in wet season crops in an acid Alfisols. In: *National Seminar on Indian Agriculture: Present situation, challenges, remedies and road map,* August 4-5, 2012, CSK HP Agricultural University Palampur (HP)- India, pp 21.

9) Suri,V.K., **Kumar, Anil,** Datt,N., Jaipaul and Choudhary, Anil K. 2012. Role of arbuscular mycorrhizal fungi in mitigating water stress in sustainable cropping systems under changing climate. Lead/ Invited Paper. National Symp. on Agril Production & Protection in context of climate change. (Nov. 3-5, 2012).BAU, Ranchi, Abstract pp 53.

10) Suri, V.K., Choudhary, **Anil K.,** Kumar, A. and Sidhu, G.S. 2013. Resource Vulnerabilities in Western Himalayas: Challenges and Mitigation Strategies. *In*: *International Conference on Impact of Technological Tools on Food Security under Global Warming Scenario (ITTFS 2012)*" held at Shobhit University, Modipuram, Meerut, India w.e.f. 11-12 May, 2013 organized by Hi-Tech Horticulture Society, Meerut & SRDA, Meerut in collaboration with SVBPUAT, Meerut & UPCAR, Lukhnow (UP). *International Conference Abstracts, Vol. I, pp*. 21*(Lead Lecture)*.

11) Suri, V.K., Choudhary, **Anil K.** and Kumar, Anil. 2013. Glycine-Glomus-Phosphate solubilizing bacteria interactions lead to fertilizer P economy in soybean (*Glycine max*. L.) in a Himalayan acid Alfisol. *In*: *International Conference on Impact of Technological Tools on Food Security under Global Warming Scenario (ITTFS 2012)*" held at Shobhit University, Modipuram, Meerut, India w.e.f. 11-12 May, 2013 organized by Hi-Tech Horticulture Society, Meerut & SRDA, Meerut in collaboration with SVBPUAT, Meerut & UPCAR, Lukhnow (UP). (Lead Paper).

12) Bengia, Bai, Suri, V.K., Choudhary, A.K. and **Kumar, A**. 2014. Effect of *Rhizobium* and AM fungi inoculation on growth, green pod yield and profitability of garden pea (*Pisum sativum*) in Himalayan acid Alfisol. *In Proc*.: National Seminar on Organic Agriculture – Challenges and Prospects, 28-29 May, 2014 at CSK HPKV, Palampur (HP). pp. 148-149.

13) **Kumar Anil**, Suri VK and Choudhary A.K. 2016. Nutritional Enrichment and Quality Enhancement through AM-fungi in Okra-Pea Cropping System in a Himalayan Acid Alfisol. In: *National Symposium on 'Transforming Indian agriculture towards food and nutritional security*, February 19-20, 2016, IGFRI, Jhansi (UP), pp 105.

14) Suri VK, **Kumar A** and Choudhary AK. 2016. Role of AM-fungi in nutrient acquisition and drought tolerance under sustainable cropping system. In: *National Symposium on 'Transforming Indian agriculture towards food and nutritional security*, February 19-20, 2016, IGFRI, Jhansi (UP), pp 77. (**Invited/Lead Paper**).

15) **Kumar A**, Singh N, Singh P, Pal S and Gupta P. 2016. Assessment of available soil nutrients under rice-wheat cropping system in district Tarn Taran of Punjab. In: *National Symposium on 'Transforming Indian agriculture towards food and nutritional security*, February 19-20, 2016, IGFRI, Jhansi (UP), pp 114-115.

16) Singh N, **Kumar A**, Pal S and Singh P. 2016. Performance of different cultivars of kharif fodder maize under late sown conditions. In: *National Symposium on 'Transforming Indian agriculture towards food and nutritional security*, February 19-20, 2016, IGFRI, Jhansi (UP), pp 162-163.

17) **Kumar A**, Singh N, Pal S and Singh P. 2015. Available soil macro and micro nutrients under rice-wheat cropping system in district Tarn Taran of Punjab. In: *National Conference on 'Push to the livestock farming through knowledge empowerment of the farmers*, October 18-20, 2015, GADVASU, Ludhiana (Punjab), pp 264-265.

18) Singh N, Singh P, **Kumar A** and Pal S. 2015. Importance of silage feeding on milk production of HF crossbred dairy animals. In: *National Conference on 'Push to the livestock farming through knowledge empowerment of the farmers*, October 18-20, 2015, GADVASU, Ludhiana (Punjab), pp 264-265.

19) Pal S, Singh P, **Kumar A** and Singh N. 2015. Evaluation of clinical animal health problems reported at Krishi Vigyan Kendra Tarn Taran during 2014-15. In: *National Conference on 'Push to the livestock farming through knowledge empowerment of the farmers*, October 18-20, 2015, GADVASU, Ludhiana (Punjab), pp 281.

20) **Kumar A.,** Kumar B., Brar NS and Singh N. 2017. Assessment of Depth-wise Irrigation Water Quality for Fodder Production in District Tarn Taran of Punjab. *In*: National Symposium On New Directions in Managing Forage Resources and Livestock Productivity in 21st Century: Challenges and Opportunities. March 3-4, 2017, RVSKVV, Gwalior (MP), pp. 25.

21) Brar NS., Kumar B., Kaur J. and **Kumar A**. 2017. Qualitative investigation of Corn Silage from cattle farms in Majha region of Punjab. *In*: National Symposium On New Directions in Managing Forage Resources and Livestock Productivity in 21st Century: Challenges and Opportunities. March 3-4, 2017, RVSKVV, Gwalior (MP), pp. 132.

22) **Kumar Anil**, Singh NS and Kumar B. 2018. Impact of fertilizer recommendations based on Soil Health Card on fertilizer consumption, Productivity and Profitability of farmers – A case study. *In*: Improving Income of Farmers through Agriculture & Aquaculture through Development Interventions. January 05-07, 2018, ICAR-CIFA, Bhubaneswar, Odisha

23) Brar NS, **Kumar A** and Kumar B. 2017. Chemical control of *Phalaris minor* in wheat in semi-arid sub-tropical regions of northern India. *In:* International conference on Global Research Initiatives for Sustainable Agriculture and Allied Sciences during December 02-04, 2017 at MPUAT, Udaipur.

24) Kumar B, Brar NS and **Kumar A**. 2017. Effect of time of sowing on yield and economics of canola gobhi sarson cultivation at farmers' field in Tarn Taran district of Punjab. *In:* International conference on Global Research Initiatives for Sustainable Agriculture and Allied Sciences during December 02-04, 2017 at MPUAT, Udaipur.

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THIS AGREEMENT is made effective as of **1st March, 2019** between **Dr Anil Kumar** ("**ASSISTANT EDITOR**") and **JOURNAL OF EXPERIMENTAL BIOLOGY AND AGRICULTURAL SCIENCES**, with its principal office located at DIDWANA, **NAGAUR, RAJASTHAN, INDIA**.

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Date: 17/02/2019